5.10 Implementation of a City-Wide NPDES Permit

The Stormwater Phase II Final Rule requires operators of small municipal separate storm sewer systems (MS4s) to obtain a National Pollutant Discharge Elimination System (NPDES) permit by October 2003. An NPDES permit is required because stormwater discharges from these MS4s are considered "point sources" of pollution. The Phase II Rule is the follow-up to the Environmental Protection Agency's (EPA's) Phase I NPDES Program. The Phase II Program expands the Phase I program by requiring additional operators of MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to manage stormwater runoff.

Specifically, the Phase II Program applies to any operators of small MS4s located in "urbanized areas" as delineated by the Bureau of the Census. A "small" MS4 is any MS4 not already covered by Phase I of the NPDES stormwater program. Small construction sites covered by this Rule include those that are between 1 and 5 acres in size. The State of California Regional Water Quality Control Board (SRWQCB) is the regulatory agency with NPDES permit oversight authority.

The City of Fortuna is currently working with the Region I – North Coast Region office of the SRWQCB on implementing a Phase II NPDES stormwater program, as required by SWRCB Water Quality Order No. 2003-005-DWQ. The final document will contain the NPDES General Permit, and outline the Stormwater Management Program and the following Six Required Minimum Control Measures:

1. Public education and outreach;
2. Public involvement/participation;
3. Illicit discharge detection and elimination;
4. Construction site stormwater runoff control;
5. Post construction stormwater management in new development and redevelopment; and
6. Pollution prevention/good housekeeping for municipal operations.

Best Management Practices (BMPs) are designated to each of the above Control Measures in order to meet the specific goals of the Measure. Refer to the City of Fortuna Stormwater Management Program for the BMPs pertaining to each Control Measure. Appropriate measures from this Management Program should be incorporated whenever construction activities take place. The City of Fortuna's draft Stormwater Management Program was last updated March 9, 2005, and is available online at:

http://www.sunnyfortuna.com/stormwater/fortuna_swmp.doc

There is a significant fiscal impact of implementing the Stormwater Management Program. One potential source of funding for the City's Stormwater Management Program is through an urban runoff management fee. The City of San Clemente was successful in implementing an urban runoff management/water quality program along with an urban runoff management fee. The fee was passed in accordance with Proposition 218 in November 2002. Proposition 218, The Right to Vote on Taxes Act, was passed by California voters in 1996, and went into effect the

following year. The intent of Proposition 218 is to ensure that all taxes and most charges on property owners are subject to voter approval. The program and associated fee were created as part of San Clemente's NPDES permit requirements. The revenue from this fee is used to fund structural urban runoff treatment projects to reduce pollution discharges along the San Clemente's beaches, street sweeping, capital projects to maintain and repair the storm drain system, water quality inspections and enforcement, and a public education and outreach program. Successful implementation of any program that falls under the requirements of Proposition 218 will require a well-organized public education and outreach campaign. In addition, the level at which any proposed fee is set will have a significant impact on the public's perception of the fee and the associated program. More information on the City of San Clemente's program may be found online at:

http://ci.san-clemente.ca.us/sc/Org/Dept/Engineering/WaterQ/

CHAPTER 6 – FUNDING AND FINANCING

6.1 General

The purpose of this Chapter is to explore the various methods of financing and administering the recommended projects set fourth in the Storm Drainage Master Plan and Capital Improvement Program. There are several factors to examine when considering potential funding for the proposed storm drainage facilities. These factors include the type of project, who the project will serve, the economic status of the service area, if there are any health or safety concerns, and the project's potential to create jobs.

There are several potential sources of funds for the City of Fortuna that would provide loans and/or grants to reduce the cost incurred by the City and/or its residents for implementation of a capital improvement project for stormwater management. Some of the more common grant and loan funding sources that have been used for storm drainage projects include the Economic Development Administration Public Works Program, Community Development Block Grants, and State Bond initiatives. These and other programs are discussed in more detail below.

6.2 Grants and Loans

Grants and loans are available through programs offered by various federal and state agencies. A description of the programs offered by each of these entities is provided here. It is important to note when considering the possibility of funding storm drainage projects through state and federal assistance programs that grant money is often severely limited, and competition for funds is intense. In addition, the future funding of these and other programs is dependent on the strength and condition of current state and federal budgets.

Economic Development Administration: The U.S. Department of Commerce Economic Development Administration (EDA) Public Works Program is designed to empower distressed communities in economic decline to revitalize, expand and upgrade their physical infrastructure to attract new industry, encourage business expansion, diversify local economics, and generate or retain long-term private sector jobs and investment. Those communities that demonstrate a "special need" for funding due to the closure or restructuring of industrial firms essential to area economics resulting in sudden job losses, or extraordinary depletion of natural resources, such as fisheries or timber, may increase their eligibility for funding under this program. For example, the planned closure of the Pacific Lumber mill site in Fortuna, and declines in timber and fisheries resources may significantly increase the City's ability to obtain funds through this program. EDA usually funds 50 percent of project cost, however certain conditions of high economic distress or an applicant's inability to provide the matching share may permit a higher grant rate. Interested applicants are encouraged to contact the appropriate EDA Regional Office or Economic Development Representative to discuss the proposal and obtain additional EDA program information, application instructions and forms. The EDA Program's Regional Office may be contacted at:

Economic Development Administration Oregon and Northern California Office One World Trade Center 121 S.W. Salmon Street, Suite 244 Portland, OR 97204 (503) 326–3078 (phone)	or	Economic Development Administration Seattle Regional Office Jackson Federal Building, Room 1890 915 Second Avenue Seattle, WA 98174 (206) 220-7660 (phone) (206) 220-7669 (fax)

Additional information may be obtained online at: http://www.eda.gov

Neighborhood Initiatives Grants: The U.S. Department of Housing and Urban Development (HUD) Community Planning and Development department provides Neighborhood Initiatives Grants for neighborhood revitalization and grant money for a variety of community and housing activities, specifically including improvement of distressed areas. Grant funds must be used to improve the conditions of distressed and blighted areas and neighborhoods, stimulate investment, economic diversification, and community revitalization in areas with population out-migration or a stagnating or declining economic base, or determine whether housing benefits can be integrated more effectively with welfare reform initiatives. The Neighborhood Initiatives staff may be contacted at (202) 708-3773 (phone) or (202) 708-7543 (fax).

Rural Housing and Economic Development Program: The U.S. Department of Housing and Urban Development (HUD) Rural Housing and Economic Development (RHED) Program was created to build capacity at the State and local level for rural housing and economic development and to support innovative housing and economic development activities in rural areas. The RHED program allows for grant money to be spent on capacity building or support for innovative housing and economic development activities. Specifically, grants may be used for the development of infrastructure to support the housing or economic development activities, preparation of plans, architectural or engineering drawings, and the purchase of construction materials. Eligible applicants are local rural non-profit groups, community development corporations, state housing finance agencies, state community and/or economic development agencies, and federally recognized Indian tribes. After HUD publishes a Notice of Funding Availability for the Rural Housing and Economic Development program, applicants must submit specific information about a proposed project or activities in their application. After HUD makes conditional selections, applicants must then submit additional information. Funds made available under this program are awarded competitively on an annual basis, through a selection process conducted by HUD in consultation with the USDA. Grants of up to $400,000 are available. The RHED program office may be contacted at:

Office of Rural Housing and Economic Development
Office of Community Planning and Development (CPD)
U. S. Department of Housing and Urban Development
451 7th Street, SW, Room 7137
Washington, DC 20410
(202) 708-2290 (phone)

Additional information is available online at:

http://www.hud.gov/offices/cpd/economicdevelopment/programs/rhed/

Community Development Block Grants: State administered Community Development Block Grants (CDBG) are federal funds from the U.S. Department of Housing and Urban Development which are administered by the state through the local county to the local community. They are available to non-entitlement areas to fund public improvement projects. Non-entitlement areas are cities with populations of less than 50,000, and counties with populations of less than 200,000. There are two CDBG programs.

The first program is for Planning and Technical Assistance grants. These grants may be used for planning and evaluation studies related to any CDBG-eligible activity, including housing studies, public works, community facilities and economic development activities that meet CDBG national objectives and provide principal benefit to low-income persons. There are two sources of Planning and Technical Assistance funds: a General Allocation and an Economic Development Allocation. The General Allocation fund focuses on housing, public works, and community facilities. The Economic Development Allocation focuses on job creation and retention through business expansion and retention projects. The Planning and Technical Assistance grants provide up to $70,000 per year per jurisdiction, with no more than $35,000 allowed under the General Allocation and a maximum of $35,000 under the Economic Development Allocation. The projects funded must principally benefit a targeted income group, which is based on the most recent U.S. Census data.

The second program is for General Allocation grants. The primary goal of this program is to develop viable communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for persons of low- and moderate-income. The purpose of the program is to fund housing activities, public works, community facilities, and public service projects. Eligible activities include the costs of acquisition, construction, or installation of the public works project and site or other improvements. Grant applications are evaluated based on seven categories as follows:

- Poverty Index (100 points) – Percentage of population with incomes below the poverty level;
- Target Income Group (300 points) – Project beneficiaries who earn 80 percent or less of the county's median income;
- Need for Activity (200 points) – Documented need for the proposed project;
- Prior Performance Operating CDBG Grants (150 points) – Performance administering past CDBG Grants; criteria include timeliness of expenditures, reporting, closeout submittals, resolving outstanding audit issues, and the amount of income in hand;
- Capacity (150 points) – Ability to administer the proposed activities, based on experience on past grants and readiness to proceed;
- Leverage (50 points) – Documented commitments of additional (non-federal or state) funding;
- State Objectives (50 points) – Additional credit for grants addressing one or more state objectives.

Grants of up to $500,000 are available for eligible projects. State CDBG money is frequently combined with funding from other federal programs to finance the construction of public facilities and other improvement projects. Funds obtained through this program are usually distributed and paid back on the basis of an assessment. The Program's California State office may be contacted at:

State of California
Division of Community Affairs
2710 Gateway Oaks Drive
North Building - Suite 190
Sacramento, CA 95833
(916) 263-0485 (phone)
(916) 263-0489 (fax)

Additional information may be obtained online at: http://www.hcd.ca.gov/ca/

Clean Water State Revolving Fund Loans: Since 1987, the State Water Resources Control Board (SWRCB) has administered a revolving loan fund authorized by the Clean Water Act of 1987. Low interest loans are available to municipalities, nonprofit organizations and private parties through the Clean Water State Revolving Fund (SRF) Loan Program. Loans may be used to help pay for projects that address water quality problems associated with public and private non-point source discharges, stormwater treatment and water reclamation, and estuary enhancement. Some examples include construction of demonstration projects, retention/detention basins, wet ponds, infiltration strips, grassy swales or any other structures intended to remove pollutants originating from non-point sources. The SRF Loan Program is administered by the SWRCB, Division of Clean Water Programs. To be eligible for a loan or grant, the applicant must be a public agency and must be recommended for placement on the statewide priority list by the Department of Health Services or the local Regional Water Quality Control Board. The SRF will fund up to 97 ½ percent of eligible costs with a maximum loan amount of $50 million per agency per year, a 20-year payback period, and an interest rate of one-half the interest rate paid on the sale of the State's latest general obligation bonds. An agency can get a zero percent interest rate loan if the agency will supply funds equal to 16.7 percent of the eligible costs. The program is capitalized by grants from the U.S. Environmental Protection Agency (USEPA), and requires a 20 percent state match. The SRF Loan Program state and regional offices may be contacted at:

State Water Resources Control Board
Division of Financial Assistance
1001 I Street, 15th Floor
Sacramento, CA 95814
(916) 323-4201

or

State Water Resources Control Board
North Coast Region (1)
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403
(707) 576-2220 (phone)
(707) 523-0135 (fax)

Additional information may be obtained online at: http://www.swrcb.ca.gov/funding/index.html

The Non-Point Source Implementation Grant Program: The 319 Program, also known as the Clean Water Act Section 319(h) Non-Point Source Implementation Grant Program, is an

annually federally funded program administered by the SWRCB with the goals of reducing, eliminating, or preventing water pollution resulting from polluted runoff (i.e., non-point sources [NPS]) and to enhance water quality in impaired waters. The Eel River is listed as an impaired water body in the State of California, as required by Section 303(d) of the Clean Water Act. This list describes water bodies that do not fully support all beneficial uses or are not meeting water quality objectives, and describes the pollutants for each water body that limit its use or prevent attainment of its water quality objectives. The Eel River watershed was listed due to water quality problems related to sedimentation. Sedimentation was determined to be impacting the cold water fishery, a beneficial use of the Eel River watershed, including the migration, spawning, reproduction, and early development of cold water fish such as Coho salmon and steelhead trout. Cold freshwater and estuarine habitats are also designated uses of the Eel River watershed. Projects that show the potential to reduce non-point sediment loading to the Eel River may be funded under this program. Approximately $5 to $6 million may be available for NPS implementation projects in California for each state fiscal year, and the amount is dependent on the funds available from USEPA. Nonprofit organizations, local government agencies including special districts (e.g., resource conservation districts or water districts), Indian Tribes, and educational institutions are eligible to receive 319 implementation funds. The California State 319 Grant Program office may be contacted at:

Lauma Jurkevics, Chief
Regional Programs Unit
State Water Resources Control Board (SWRCB)
Division of Financial Assistance, SWRCB
1001 I Street, 15th Floor, Sacramento, CA 95814
(916) 341-5498

Additional information may be obtained online at: http://www.swrcb.ca.gov/funding/index.html

Urban Streams Restoration Program: The California Department of Water Resources (DWR) Urban Streams Restoration Program assists communities in reducing damages from stream bank and watershed instability and floods while restoring the environmental and aesthetic values of streams, and to encourage stewardship and maintenance of streams by the community. Assistance is in the form of grants The Program will be making available $4.575 million in Proposition 40 funding for stream restoration projects for the fiscal year 2004-2005 funding cycle. The Urban Streams Restoration Program office may be contacted at:

Margie Graham		**Sara Denzler**
North District		Program Coordinator
2440 Main Street	or	P.O. Box 942836
Red Bluff, CA 96080		Sacramento, CA 94236-0001
(530) 529-7330 (phone)		(916) 651-9625 (phone)

Additional information may be obtained online at:

http://www.watershedrestoration.water.ca.gov/urbanstreams/

California Coastal Conservancy Programs: The California Coastal Conservancy, established in 1976, is a state agency that uses entrepreneurial techniques to purchase, protect, restore, and

enhance coastal resources, and to provide access to the shore. The Coastal Conservancy's Urban Waterfronts Program may be potential sources of grant funding for storm drainage projects in areas within the coastal zone near Fortuna. The Coastal Zone boundary parallels U.S. Highway 101 to the west at the north edge of the City limits. It runs south and parallels the eastern edge of the Eel River along the levee, coming back to U.S. Highway 101 at the Kenmar Road exit. The urban waterfront program provides capital funds and technical assistance to protect, restore and expand coastal-dependent recreational, commercial and industrial facilities and to expand opportunities for public access and use of urban waterfronts in conjunction with new development, including the provision of technical assistance to landowners and local governments and through land acquisition and the construction and restoration of facilities. The Coastal Conservancy may be contacted at:

California Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612
(510) 286-1015 (Phone)
(510) 286-0470 (Fax)

Additional information may be obtained online at: http://www.coastalconservancy.ca.gov/

Future State Loan and Grant Funding: Funding for existing and future State loan and grant programs may become available through the voter passed Proposition 40, the Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002, and/or Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Proposition 40 allows the State to borrow two billion six hundred million dollars ($2,600,000,000) through the sale of general obligation bonds for development, restoration, and acquisition of state and local parks, recreation areas and historical resources, and for land, air, and water conservation programs. Proposition 50 allows the State to borrow three billion four hundred forty million dollars ($3,440,000,000) through the sale of general obligation bonds for a variety of water projects including coastal protection, the CALFED Bay-Delta Program, integrated regional water management, safe drinking water, and water quality. The grant programs to disburse these funds have not yet been finalized. Proposals are expected out in the summer/fall of 2004 or later.

6.3 Other Financing Options

The following section describes other funding options available to the City which may be used to finance storm drainage projects. Some of these options include the formation of assessment districts, sales taxes, a general obligation bond, and drainage fees.

Formation of a Flood Control Benefit Assessment District: An assessment district is an area within a public agency's corporate boundaries containing parcels that will receive a special benefit from the construction of stormwater facilities. It does not have to incorporate the entire study area. Any property owner can petition for an assessment district. Assessment districts may be created by either a 50 percent majority voter approval among the owners of the property that would be benefited, weighted based on assessment, or by a unilateral action of the governing body. The sale of bonds secured by special assessment liens would be required unless all property owners elect to pay their assessments in cash. In recent years some storm assessments

have been successfully passed by voter approval, however the yes vote was influence by a decrease in flood insurance fees paid by homeowners.

Proposition 218 Stormwater Property Fee, Special Tax, or Assessment: In November 1996 California voters passed Proposition 218 "The Right To Vote on Taxes Act". The intent of Proposition 218 is to ensure that all taxes and most charges on property owners are subject to voter approval. Proposition 218 restricts local governments' ability to impose assessments and property-related fees, and requires elections to approve many local government revenue raising methods. Under Proposition 218 the adoption of a property related fee requires a public hearing and voter approval, and is required to reflect the cost of service. This significantly impacted the ability of public agencies to levy charges for storm or floodwater management purposes. In order to impose a stormwater property fee under Proposition 218 an agency would hold a hearing 45 days after the mailing of notification of the establishment of the fee. If a majority of affected property owners submitted written protests to the proposed fee, it would be rejected. If a majority did not protest, then the agency would hold an election on the imposition of the fee to be decided by a majority of property owners or two-thirds of the electorate. A stormwater special tax or fee would require a two-thirds vote of the electorate and a stormwater assessment would require a two-thirds vote of electorate or majority of property owners by weight of assessment.

Sales Tax Funding: Funding by a sales tax is another voted option. In 1998 Napa County passed a one-half of one percent transaction and use tax titled the "Flood Protection Sales Tax." The County established a Flood Protection and Watershed Improvement Expenditure Plan describing the types of projects that qualify for funding with the proceeds of the Flood Protection Sales Tax. Authorization of a sales tax surcharge requires a two-thirds voter approval.

Creation of a Flood Control Funding Charge that Builds in Beneficiaries: This option would be a voted charge or assessment which creates consensus for a positive vote by building a block of beneficiaries over whom costs can be levied and/or support can be gained including: environmental concerns, habitat restoration, recreation facilities, streets, storm drains, and bike paths. The agency of a flood control district must first prepare a report containing a description and the amount of assessment of each effected parcel. Next, a public hearing is set to receive public comment, and any changes or modifications to the assessments are made and confirmed by resolution. A 50 percent majority voter approval is required before the district is authorized to levy these assessments. This approval may be secured by a district-wide election or by a special ballot mailed to each property owner or registered voter of the district or zone. This effort would require a complex, coordinated effort to build consensus between different advocacy groups on the elements of such a plan. This is not so much a solution in itself, but rather an option for helping to implement the options discussed above.

General Obligation (GO) Bond: A 20 or 30 year GO bond could be voted to pay for some or all of the capital improvements recommended in this Storm Drainage Master Plan. This would require a two-thirds vote of the public. A GO bond could only be used to fund capital costs. Only projects whose lives are greater than the tem of the financing can be funded using bonds. Any voted option would require substantial lead-time in order to mount a successful public education campaign in order to secure support.

Developer Financed Projects: Another method of financing new storm drainage projects is to hold the developer of a new subdivision responsible for storm drainage facility costs both on and off site. This option may include the requirement to connect to the nearest existing stormwater facility that is adequately sized to handle the increased flow. It may also require that off-site stormwater facilities be upsized for a distance downstream, depending on downstream development potential.

If additional upsizing is required above the sizing for the new development due to potential downstream development it may be appropriate to consider constructing a larger system. The added cost may be borne by the developer who can establish an agreement to be reimbursed as other developments connect to the system. Another option is for a public agency to advance the additional costs of upsizing drainage systems for potential future growth, and then collecting reimbursements in the form of drainage development fees as development occurs.

As the City continues to develop, it is recommended that the Community Development Department require planners, developers and owners to incorporate onsite and regional stormwater detention and/or retention into their development plans. Detention differs from retention in that retention involves capturing runoff without release, and detention involves temporary storage and release. Such facilities will help in reducing the amount of runoff that enters the existing storm drainage system, and may help postpone or eliminate the need for some of the storm drainage projects proposed in this report. *An additional recommendation is that the Community Development Department requires that new development not increase the existing estimated 25-year peak runoff volume from a site. Any increase in runoff beyond the peak 25-year event resulting from new development should be retained or detained on site at the expense of the developer/owner.*

Drainage Maintenance Fee: Under Chapter 13.08 of the Fortuna Municipal Code, The City Council from time to time shall, by resolution, adopt a schedule of service charges and fees which will enable the City to operate and maintain the stormwater drainage system. These charges shall be levied against the owner or tenant of any developed parcel of property that discharges stormwater runoff into the city's drainage system. The ability of the City to adopt such drainage service charges were set fourth in Ordinance 93-583, and approved by the City Council of Fortuna in 1993. This ordinance also created a stormwater drainage enterprise and utility to administer the City's stormwater drainage facilities, and a stormwater drainage fund to provide funding for stormwater drainage maintenance. The purpose of the enterprise and utility is to collect and manage stormwater maintenance fees from property owners. The stormwater drainage fund is a separate account where the fees are deposited for use in future storm drainage projects and maintenance. The ordinance describes the classification of users, type of service charge, relief from unjust rates, billing, collection, prohibitions and permit requirements. Currently, the City charges customers a $0.55 per month storm drainage maintenance fee. This fee was established at the time City Ordinance 93-583 was adopted. Section 13.80.020 of the Fortuna Municipal Code states, "The council reserves the right and power to from time to time by resolution adopt rules and regulations for the operation and maintenance of the stormwater drainage facilities of the city, and may likewise by resolution establish and modify the rates, charges, and penalties of the utility. (Ord. 93-583)." However, because the City Charter and City Code do not provide a formula or method of calculating increases, any increase to this fee may

be subject to the requirements of Proposition 218. The City attorney should be consulted in matters of drainage maintenance fee increases.

Drainage Development Fee: The City of Fortuna assesses a storm drainage development fee for each parcel of new land within the City limits, as well as a fee based on square footage of impervious developed area. At the time of subdivision, each new parcel is assessed a fee of $600. When the parcel is developed, a fee of $0.32 per square foot of impervious surface area is then assessed. If the development fee is less than the parcel fee, then the difference is refunded. The fee is never greater than $600.

Appendix A
Example Rational Method Calculations

Rational Method for Calculating Stormwater Runoff

The following pages summarize the Rational Method for calculating stormwater runoff used in the hydrology analysis of this report. The summary includes step-by-step instructions for computing runoff using area, flow type (overland or pipe flow), time of concentration, precipitation intensity, and the runoff coefficient "C". An example calculation for a simple fictional drainage area is provided on the last page.

Step 1: Within the drainage basin, determine the area, A (in acres), associated with each land use for each sub-basin (i.e. point of concentration). Calculate the composite runoff coefficient, $C_{composite}$, for the entire basin. Enter the total sub-basin area in Column 12, and enter the composite runoff coefficient in Column 2. Use the equation below to calculate the composite runoff coefficient:

$$C_{composite} = \frac{\sum_{i=1}^{n} C_i A_i}{\sum_{i=1}^{n} A_i}$$

where:

i = Sub-basin
C_i = Runoff Coefficient "C" for Sub-basin i
A_i = Area of Sub-basin i
n = Total Number of Sub-basins.

Step 2: Calculate the cumulative upstream area for each sub-basin (point of concentration), and enter the value in Column 13. The cumulative area is equal to the area of the sub-basin plus the total upstream area contributing to runoff seen at that point of concentration.

Step 3: Determine the runoff travel distance (longest travel distance for runoff) and elevation change (change in elevation over the travel distance) for each sub-basin. Enter the elevation change for each sub-basin in Column 3, and enter the travel distance for each sub-basin in Column 4.

Step 4: Calculate travel slope. If flow is overland flow (only at the upper most sub-basin(s)), then the slope is equal to the elevation change divided by the travel distance. If flow is in a pipe, enter the slope of the pipe. Enter the value of the slope in Column 5.

Step 5: Calculate the estimated flow rate. Assume 1.0 cubic foot per second (cfs) of flow for every acre of contributing area. The estimated flow rate should equal the cumulative upstream area for each sub-basin (Column 13). This value is used to determine a "ball park" estimate of the flow. This estimate should be somewhere between the 10-year and 100-year flow, plus or minus 5 cfs. Enter the estimated flow rate in Column 6. The estimated flow rate is used to calculate the overland flow velocity (Step 6).

Step 6: Enter the Manning's "n" roughness coefficient corresponding to the pipe material upstream of and including each point of concentration in Column 7 (if applicable). Refer to "notes" column for pipe material.

Step 7: Calculate the hydraulic radius of the pipe, R, if applicable using the following equation, and enter the value in Column 8:

R = D/4 = Hydraulic Radius of Pipe (ft)
D = Pipe Diameter (ft)

Refer to the "notes" column for pipe sizes.

Step 8: Calculate the flow velocity, and enter the value in Column 9. If flow is overland, use the following equation:

$$V = 5.46 \cdot S^{0.486} \cdot Q^{0.3287}$$

where: V = Velocity (ft/sec)

S = Slope (ft/ft)

Q = Estimated Flow Rate (cfs)

If flow is within a pipe, use Manning's equation with appropriate roughness coefficient:

$$V = \frac{1.49}{n} \cdot R^{2/3} \cdot S^{1/2}$$

where: n = Manning's Roughness Coefficient (unitless)

Step 9: Calculate the travel time in minutes (time of concentration for each sub-basin), and enter the value in Column 10. The travel time is equal to the runoff travel distance (Column 4) divided by the flow velocity (Column 9), with the appropriate unit change. Add 10 minutes to the travel time for the upstream most area for conservativeness and to ensure that the time of concentration is *at least* 10 minutes.

Step 10: Calculate the total travel time, and enter the value in Column 11. The total travel time is a cumulative time of concentration. It is determined by adding the time required for water to travel from the upstream point of concentration to the downstream point of concentration to the previous inlet time, similar to the cumulative upstream area (Step 2). The highest inlet time is always carried through to the next downstream area. This cumulative inlet time is the time of concentration for the entire upstream area contributing to the flow at that point of concentration.

Step 11: Enter values for the coefficient K in Column 14. The coefficient, K, is a factor used to maintain unit consistency, and is equal to 1.0 ft^3/s per acre·in/hr for U.S. Standard Units. For S.I. units, K equals 0.00278 m^3/s per hectare·mm/hr.

Step 12: Calculate the values of KAC, and enter them in Column 15. That is, the coefficient K (Column 14) multiplied by the area A (Column 12) multiplied by the composite runoff coefficient (Column 2).

Step 13: Calculate the cumulative values of ΣKAC, and enter them in Column 16. For each sub-basin, the value of ΣKAC is equal to the value of ΣKAC for the upstream sub-basin plus the value of KAC for the current sub-basin. At the most upstream sub-basin, the value of ΣKAC equals KAC.

Step 14: From the Intensity-Duration-Frequency curves, determine the precipitation intensities (in/hr) for the 10-year and 100-year events corresponding to the total travel times in Column 11 (times of concentration). Enter the 10-year intensities in Column 17 and the 100-year intensities in Column 19.

Step 15: Calculate the estimates for 10-year and 100-year runoff by multiplying the value of ΣKAC in Column 16 by the precipitation intensities in Column 17 and Column 19, respectively. Enter the 10-year runoff in Column 18 and the 100-year runoff in Column 20.

Appendix B
StormCAD & FlowMaster Hydraulic Model Results

Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	10	Number of Inlets	9
- Circular Pipes:	10	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	1	- Generic Inlets:	9
Number of Outlets	1		

Circular Pipes Inventory			
18 inch	577.00 ft	42 inch	712.00 ft
24 inch	2,153.00 ft	48 inch	1,235.00 ft
30 inch	780.00 ft		
Total Length	5,457.00 ft		

Generic Inlet Inventory	
Default 100%	9

Inlet elements for network with outlet: O-1.3

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.3	Generic Default 1	150.0	0.0	0.0	N/A	100.0	45.68	44.58	1.11	Standar
1.4	Generic Default 1	150.0	0.0	0.0	N/A	100.0	51.16	50.05	1.11	Standar
1.5	Generic Default 1	140.0	0.0	0.0	N/A	100.0	51.74	50.78	0.96	Standar
1.6	Generic Default 1	130.0	0.0	0.0	N/A	100.0	54.43	53.60	0.83	Standar
1.7	Generic Default 1	120.0	0.0	0.0	N/A	100.0	64.85	63.64	1.21	Standar

Junction elements for network with outlet: O-1.3

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
J-1	58.34	57.13	1.21	Standar	0.0	120.0	0.0	0.00	0.64	0.00

Worksheet for 24'x13' RCB Capacity Analysis

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.00500	ft/ft
Normal Depth:	12.00	ft
Bottom Width:	24.00	ft
Results		
Discharge:	7685.94	ft^3/s
Flow Area:	288.00	ft^2
Wetted Perimeter:	48.00	ft
Top Width:	24.00	ft
Critical Depth:	14.72	ft
Critical Slope:	0.00292	ft/ft
Velocity:	26.69	ft/s
Velocity Head:	11.07	ft
Specific Energy:	23.07	ft
Froude Number:	1.36	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	12.00	ft
Critical Depth:	14.72	ft
Channel Slope:	0.00500	ft/ft
Critical Slope:	0.00292	ft/ft

Analysis Results
Scenario: Improvements

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary

Scenario	Improvements
Physical Properties Alternat	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-Improvements
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory

Number of Pipes	4	Number of Inlets	4
- Circular Pipes:	4	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	4
Number of Outlets	1		

Circular Pipes Inventory

18 inch	329.00 ft	36 inch	1,945.00 ft
Total Length	2,274.00 ft		

Generic Inlet Inventory

Default 100%	4

Outlet: 4.11.2

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
4.11.2	70.75	70.75	0.00	0.00	15.00	0.00	0.00	1.97	0.00

Inlet elements for network with outlet: 4.11.2

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
4.11.3	Generic Default 1	15.00	0.00	0.00	N/A	100.0	76.66	74.60	2.06	Standar
4.11.4	Generic Default 1	90.00	0.00	0.00	N/A	100.0	99.50	98.19	1.31	Standar
4.11.5	Generic Default 1	76.00	0.00	0.00	N/A	100.0	114.71	113.73	0.98	Standar

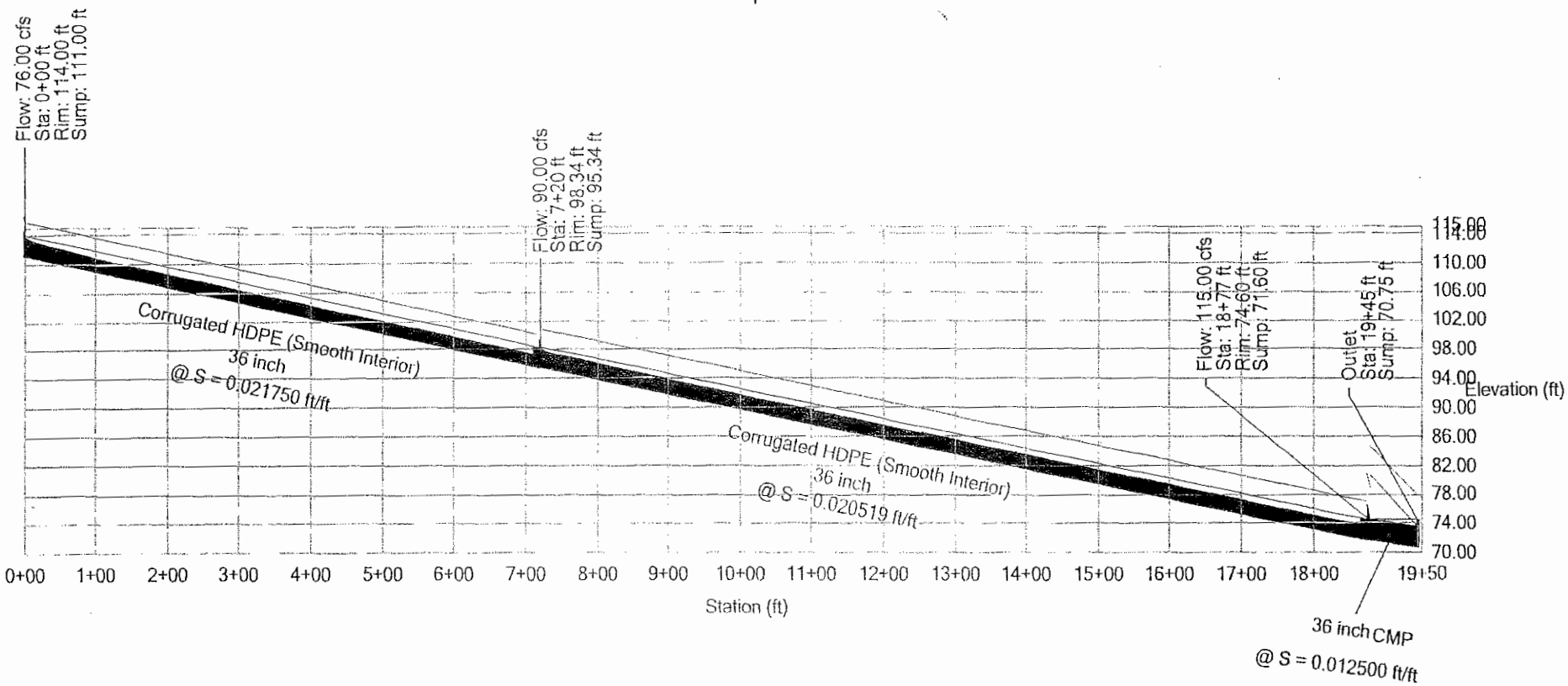
Analysis Results
Scenario: Improvements

Pipe elements for network with outlet: 4.11.2

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Circular	36 inch	720.00	1	0.021750	021613	76.00	16.38	111.00	95.34	113.73	98.34
P-2	Circular	36 inch	,157.00	1	0.020519	020473	90.00	16.49	95.34	71.60	98.19	74.60
P-4	Circular	36 inch	68.00	1	0.012500	101312	15.00	16.27	71.60	70.75	80.62	73.69

Profile: Profile - 1

Scenario: Improvements



Analysis Results
Scenario: Improvements

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary	
Scenario	Improvements
Physical Properties Alternat	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-Improvements
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	4	Number of Inlets	4
- Circular Pipes:	4	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	4
Number of Outlets	1		

Circular Pipes Inventory			
18 inch	329.00 ft	36 inch	1,945.00 ft
Total Length	2,274.00 ft		

Generic Inlet Inventory	
Default 100%	4

Outlet: 4.11.2

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
4.11.2	70.75	70.75	0.00	0.00	15.00	0.00	0.00	1.97	0.00

Inlet elements for network with outlet: 4.11.2

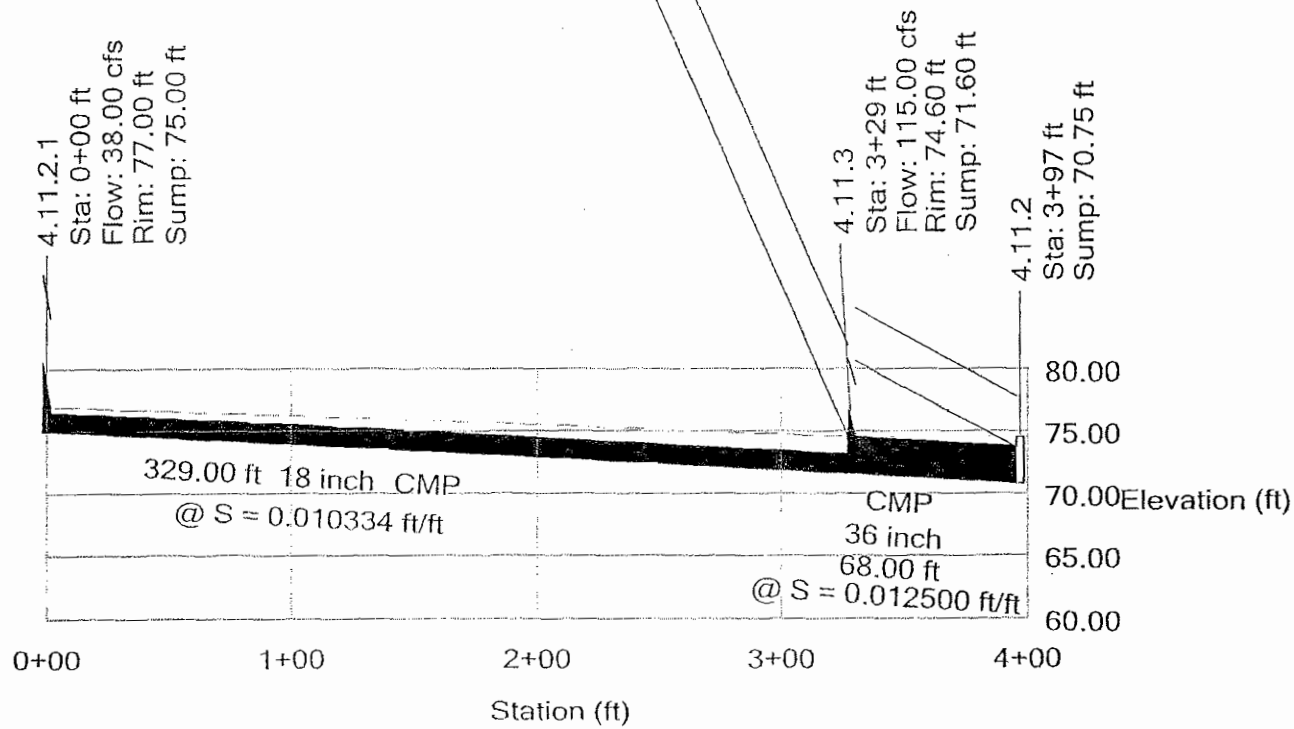
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
4.11.2.1	Generic Default 1	38.00	0.00	0.00	N/A	100.0	80.59	77.00	3.59	Standar
4.11.3	Generic Default 1	15.00	0.00	0.00	N/A	100.0	76.66	74.60	2.06	Standar

Analysis Results
Scenario: Improvements

Pipe elements for network with outlet: 4.11.2												
Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-3	Circular	18 inch	29.00	1	0.010334	446080	38.00	21.50	75.00	71.60	221.36	74.60

Profile: Improvement Profile

Scenario: Improvements



Worksheet for Trapezoidal Channel - Node 6.1.1

Project Description		
Flow Element:	Trapezoidal Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.030	
Channel Slope:	0.00630	ft/ft
Normal Depth:	2.00	ft
Left Side Slope:	2.00	ft/ft (H:V)
Right Side Slope:	2.00	ft/ft (H:V)
Bottom Width:	3.00	ft
Results		
Discharge:	61.19	ft^3/s
Flow Area:	14.00	ft^2
Wetted Perimeter:	11.94	ft
Top Width:	11.00	ft
Critical Depth:	1.65	ft
Critical Slope:	0.01418	ft/ft
Velocity:	4.37	ft/s
Velocity Head:	0.30	ft
Specific Energy:	2.30	ft
Froude Number:	0.68	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	2.00	ft
Critical Depth:	1.65	ft
Channel Slope:	0.00630	ft/ft

Worksheet for Trapezoidal Channel - Node 6.1.1

Critical Slope: 0.01418 ft/ft

Worksheet for Node 6.1.2 - 48" RCP Culvert

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.02400	ft/ft
Normal Depth:	4.00	ft
Diameter:	4.00	ft
Results		
Discharge:	222.52	ft^3/s
Flow Area:	12.57	ft^2
Wetted Perimeter:	12.57	ft
Top Width:	0.00	ft
Critical Depth:	3.90	ft
Percent Full:	100.0	%
Critical Slope:	0.02127	ft/ft
Velocity:	17.71	ft/s
Velocity Head:	4.87	ft
Specific Energy:	8.87	ft
Froude Number:	0.00	
Maximum Discharge:	239.37	ft^3/s
Discharge Full:	222.52	ft^3/s
Slope Full:	0.02400	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.1.2 - 48" RCP Culvert

Upstream Velocity:	Infinity	ft/s
Normal Depth:	4.00	ft
Critical Depth:	3.90	ft
Channel Slope:	0.02400	ft/ft
Critical Slope:	0.02127	ft/ft

Worksheet for Node 6.2 - 10'x5' RCB

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.015	
Channel Slope:	0.01000	ft/ft
Normal Depth:	4.50	ft
Bottom Width:	10.00	ft

Results		
Discharge:	792.06	ft^3/s
Flow Area:	45.00	ft^2
Wetted Perimeter:	19.00	ft
Top Width:	10.00	ft
Critical Depth:	5.80	ft
Critical Slope:	0.00509	ft/ft
Velocity:	17.60	ft/s
Velocity Head:	4.81	ft
Specific Energy:	9.31	ft
Froude Number:	1.46	
Flow Type:	Supercritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	4.50	ft
Critical Depth:	5.80	ft
Channel Slope:	0.01000	ft/ft
Critical Slope:	0.00509	ft/ft

Worksheet for Node 6.3 - 72" CSP

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.024	
Channel Slope:	0.01500	ft/ft
Normal Depth:	6.00	ft
Diameter:	6.00	ft
Results		
Discharge:	280.94	ft^3/s
Flow Area:	28.27	ft^2
Wetted Perimeter:	18.85	ft
Top Width:	0.00	ft
Critical Depth:	4.59	ft
Percent Full:	100.0	%
Critical Slope:	0.01726	ft/ft
Velocity:	9.94	ft/s
Velocity Head:	1.53	ft
Specific Energy:	7.53	ft
Froude Number:	0.00	
Maximum Discharge:	302.21	ft^3/s
Discharge Full:	280.94	ft^3/s
Slope Full:	0.01500	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.3 - 72" CSP

Upstream Velocity:	Infinity	ft/s
Normal Depth:	6.00	ft
Critical Depth:	4.59	ft
Channel Slope:	0.01500	ft/ft
Critical Slope:	0.01726	ft/ft

Worksheet for Node 6.3.1 - 30" RCP

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.31100	ft/ft
Normal Depth:	2.50	ft
Diameter:	2.50	ft
Results		
Discharge:	228.73	ft^3/s
Flow Area:	4.91	ft^2
Wetted Perimeter:	7.85	ft
Top Width:	0.00	ft
Critical Depth:	2.50	ft
Percent Full:	100.0	%
Critical Slope:	0.30717	ft/ft
Velocity:	46.60	ft/s
Velocity Head:	33.74	ft
Specific Energy:	36.24	ft
Froude Number:	0.00	
Maximum Discharge:	246.05	ft^3/s
Discharge Full:	228.73	ft^3/s
Slope Full:	0.31100	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.3.1 - 30" RCP

Upstream Velocity:	Infinity	ft/s
Normal Depth:	2.50	ft
Critical Depth:	2.50	ft
Channel Slope:	0.31100	ft/ft
Critical Slope:	0.30717	ft/ft

Worksheet for Node 6.3.2 - 30" RCP

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01500	ft/ft
Normal Depth:	2.50	ft
Diameter:	2.50	ft
Results		
Discharge:	50.23	ft^3/s
Flow Area:	4.91	ft^2
Wetted Perimeter:	7.85	ft
Top Width:	0.00	ft
Critical Depth:	2.30	ft
Percent Full:	100.0	%
Critical Slope:	0.01302	ft/ft
Velocity:	10.23	ft/s
Velocity Head:	1.63	ft
Specific Energy:	4.13	ft
Froude Number:	0.00	
Maximum Discharge:	54.04	ft^3/s
Discharge Full:	50.23	ft^3/s
Slope Full:	0.01500	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.3.2 - 30" RCP

Upstream Velocity:	Infinity	ft/s
Normal Depth:	2.50	ft
Critical Depth:	2.30	ft
Channel Slope:	0.01500	ft/ft
Critical Slope:	0.01302	ft/ft

Worksheet for Node 6.6a

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.02000	ft/ft
Normal Depth:	2.50	ft
Diameter:	2.50	ft
Results		
Discharge:	62.84	ft^3/s
Flow Area:	4.91	ft^2
Wetted Perimeter:	7.85	ft
Top Width:	0.00	ft
Critical Depth:	2.41	ft
Percent Full:	100.0	%
Critical Slope:	0.01749	ft/ft
Velocity:	12.80	ft/s
Velocity Head:	2.55	ft
Specific Energy:	5.05	ft
Froude Number:	0.00	
Maximum Discharge:	67.59	ft^3/s
Discharge Full:	62.84	ft^3/s
Slope Full:	0.02000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.6a

Upstream Velocity:	Infinity	ft/s
Normal Depth:	2.50	ft
Critical Depth:	2.41	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.01749	ft/ft

Worksheet for Node 6.6b

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.02000	ft/ft
Normal Depth:	4.00	ft
Diameter:	4.00	ft

Results		
Discharge:	220.06	ft^3/s
Flow Area:	12.57	ft^2
Wetted Perimeter:	12.57	ft
Top Width:	0.00	ft
Critical Depth:	3.89	ft
Percent Full:	100.0	%
Critical Slope:	0.01769	ft/ft
Velocity:	17.51	ft/s
Velocity Head:	4.77	ft
Specific Energy:	8.77	ft
Froude Number:	0.00	
Maximum Discharge:	236.72	ft^3/s
Discharge Full:	220.06	ft^3/s
Slope Full:	0.02000	ft/ft
Flow Type:	SubCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.6b

Upstream Velocity:	Infinity	ft/s
Normal Depth:	4.00	ft
Critical Depth:	3.89	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.01769	ft/ft

Worksheet for Node 6.4.2 & 6.6 - 3'x3' RCB

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.02000	ft/ft
Normal Depth:	3.00	ft
Bottom Width:	3.00	ft
Results		
Discharge:	145.48	ft^3/s
Flow Area:	9.00	ft^2
Wetted Perimeter:	9.00	ft
Top Width:	3.00	ft
Critical Depth:	4.18	ft
Critical Slope:	0.00902	ft/ft
Velocity:	16.16	ft/s
Velocity Head:	4.06	ft
Specific Energy:	7.06	ft
Froude Number:	1.65	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	3.00	ft
Critical Depth:	4.18	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.00902	ft/ft

Worksheet for Node 6.6.2.1 - 18" RCP

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.03610	ft/ft
Normal Depth:	1.50	ft
Diameter:	1.50	ft

Results		
Discharge:	19.96	ft^3/s
Flow Area:	1.77	ft^2
Wetted Perimeter:	4.71	ft
Top Width:	0.00	ft
Critical Depth:	1.47	ft
Percent Full:	100.0	%
Critical Slope:	0.03221	ft/ft
Velocity:	11.29	ft/s
Velocity Head:	1.98	ft
Specific Energy:	3.48	ft
Froude Number:	0.00	
Maximum Discharge:	21.47	ft^3/s
Discharge Full:	19.96	ft^3/s
Slope Full:	0.03610	ft/ft
Flow Type:	SubCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.6.2.1 - 18" RCP

Upstream Velocity:	Infinity	ft/s
Normal Depth:	1.50	ft
Critical Depth:	1.47	ft
Channel Slope:	0.03610	ft/ft
Critical Slope:	0.03221	ft/ft

Worksheet for Node 6.8.2.2 - 36" N12

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.18810	ft/ft
Normal Depth:	3.00	ft
Diameter:	3.00	ft

Results		
Discharge:	313.36	ft^3/s
Flow Area:	7.07	ft^2
Wetted Perimeter:	9.42	ft
Top Width:	0.00	ft
Critical Depth:	3.00	ft
Percent Full:	100.0	%
Critical Slope:	0.18503	ft/ft
Velocity:	44.33	ft/s
Velocity Head:	30.54	ft
Specific Energy:	33.54	ft
Froude Number:	0.00	
Maximum Discharge:	337.09	ft^3/s
Discharge Full:	313.36	ft^3/s
Slope Full:	0.18810	ft/ft
Flow Type:	SubCritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Node 6.8.2.2 - 36" N12

Upstream Velocity:	Infinity	ft/s
Normal Depth:	3.00	ft
Critical Depth:	3.00	ft
Channel Slope:	0.18810	ft/ft
Critical Slope:	0.18503	ft/ft

Worksheet for 10'x5' RCB Bridge Channel

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.00500	ft/ft
Normal Depth:	5.00	ft
Bottom Width:	10.00	ft
Results		
Discharge:	744.39	ft^3/s
Flow Area:	50.00	ft^2
Wetted Perimeter:	20.00	ft
Top Width:	10.00	ft
Critical Depth:	5.56	ft
Critical Slope:	0.00377	ft/ft
Velocity:	14.89	ft/s
Velocity Head:	3.44	ft
Specific Energy:	8.44	ft
Froude Number:	1.17	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	5.00	ft
Critical Depth:	5.56	ft
Channel Slope:	0.00500	ft/ft
Critical Slope:	0.00377	ft/ft

Worksheet for 3'x3' RCB Bridge Channel

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01000	ft/ft
Normal Depth:	3.00	ft
Bottom Width:	3.00	ft
Results		
Discharge:	102.87	ft^3/s
Flow Area:	9.00	ft^2
Wetted Perimeter:	9.00	ft
Top Width:	3.00	ft
Critical Depth:	3.32	ft
Critical Slope:	0.00783	ft/ft
Velocity:	11.43	ft/s
Velocity Head:	2.03	ft
Specific Energy:	5.03	ft
Froude Number:	1.16	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	3.00	ft
Critical Depth:	3.32	ft
Channel Slope:	0.01000	ft/ft
Critical Slope:	0.00783	ft/ft

Analysis Results
Scenario: Base

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	8
- Circular Pipes:	8	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	8
Number of Outlets	2		

Circular Pipes Inventory			
18 inch	1,048.00 ft	30 inch	1,114.00 ft
24 inch	2,588.00 ft	36 inch	1,442.00 ft
Total Length	6,192.00 ft		

Generic Inlet Inventory	
Default 100%	8

Outlet: 6.6.1

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
6.6.1	128.30	128.30	0.00	0.00	75.00	0.00	0.00	3.81	0.00

Inlet elements for network with outlet: 6.6.1

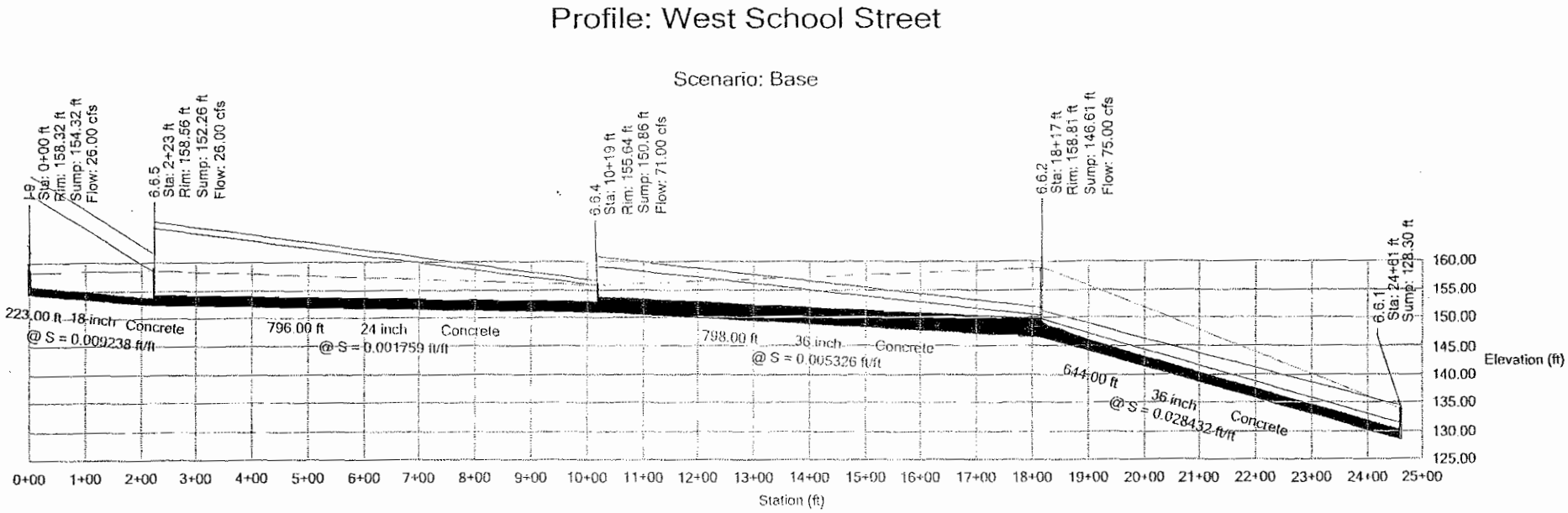
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Headloss (ft)	Headloss Method
6.6.2	Generic Default 1	75.00	0.00	0.00	N/A	100.0	150.29	149.33	0.96	Standar
6.6.4	Generic Default 1	71.00	0.00	0.00	N/A	100.0	156.42	155.64	0.78	Standar
6.6.5	Generic Default 1	26.00	0.00	0.00	N/A	100.0	159.09	158.56	0.53	Standar
I-9	Generic Default 1	26.00	0.00	0.00	N/A	100.0	160.00	158.32	1.68	Standar

Analysis Results
Scenario: Base

Pipe elements for network with outlet: 6.6.1

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-4	Circular	24 inch	96.00	1	0.001759	013210	26.00	8.28	152.26	150.86	166.16	155.64
P-7	Circular	36 inch	44.00	1	0.028432	025863	75.00	17.03	146.61	128.30	149.33	130.09
P-9	Circular	18 inch	23.00	1	0.009238	061271	26.00	14.71	154.32	152.26	172.22	158.56
P-10	Circular	36 inch	98.00	1	0.005326	011333	71.00	10.04	150.86	146.61	159.34	150.29

Profile
Scenario: Base



Analysis Results
Scenario: Base

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	8
- Circular Pipes:	8	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	8
Number of Outlets	2		

Circular Pipes Inventory			
18 inch	1,048.00 ft	30 inch	1,114.00 ft
24 inch	2,588.00 ft	36 inch	1,442.00 ft
Total Length	6,192.00 ft		

Generic Inlet Inventory	
Default 100%	8

Inlet elements for network with outlet: 6.6.1

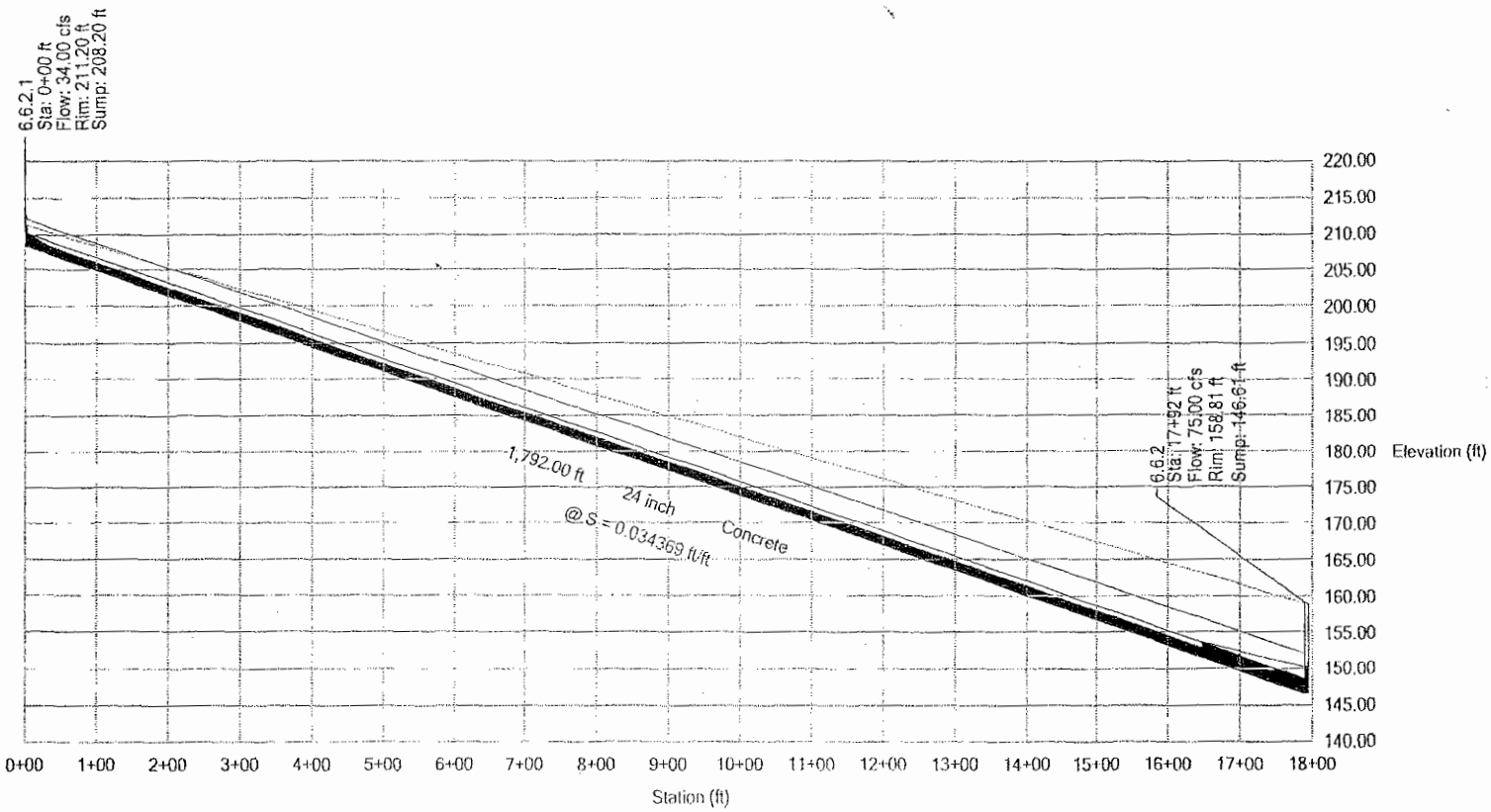
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
6.6.2	Generic Default 1	75.00	0.00	0.00	N/A	100.0	150.29	149.33	0.96	Standar
6.6.2.1	Generic Default 1	34.00	0.00	0.00	N/A	100.0	211.05	210.11	0.94	Standar

Pipe elements for network with outlet: 6.6.1

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-8	Circular	24 incl	,792.00	1	0.034369	033413	34.00	14.87	208.20	146.61	210.11	150.29

Profile: Wood St.

Scenario: Base



Detailed Report for Pipe: P-1

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-3.2.1		Number of Sections	1	
Downstream Node	O-3.2		Section Shape	Circular	
Bend Angle	0.00	degrees	Section Size	36 inch	
Length	641.00	ft	Material	Concrete	
Constructed Slope	0.006240	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	56.00	cfs	Full Capacity	52.69	cfs
Profile Description	M2		Energy Slope	0.006323	ft/ft
Gravity Element Headloss	4.26	ft	Velocity In	8.40	ft/s
Average Velocity	8.40	ft/s	Velocity Out	9.14	ft/s
Constructed Slope	0.006240	ft/ft	Design Capacity	52.69	cfs
Excess Full Capacity	-3.31	cfs	Excess Design Capacity	-3.31	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	62.00	67.00	65.00	2.00	2.68	64.68	65.78
Downstrear	58.00	61.00	61.00	0.00	2.43	60.43	61.73

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message
	Warning: Pipe does not meet minimum cover constraint.

Detailed Report for Pipe: P-1

Message List	
Time (hr)	Message
	Warning: Pipe discharge is above full flow capacity.
	Warning: Pipe discharge is above design capacity.

Detailed Report for Pipe: P-2

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-3.2.2		Number of Sections	1	
Downstream Node	I-3.2.1		Section Shape	Circular	
Bend Angle	0.15	degrees	Section Size	36 inch	
Length	433.00	ft	Material	Concrete	
Constructed Slope	0.002309	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	46.00	cfs	Full Capacity	32.05	cfs
Profile Description	Pressure		Energy Slope	0.004757	ft/ft
Gravity Element Headloss	2.06	ft	Velocity In	6.51	ft/s
Average Velocity	6.51	ft/s	Velocity Out	6.51	ft/s
Constructed Slope	0.002309	ft/ft	Design Capacity	32.05	cfs
Excess Full Capacity	-13.95	cfs	Excess Design Capacity	-13.95	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	63.00	68.00	66.00	2.00	4.29	67.29	67.95
Downstrear	62.00	67.00	65.00	2.00	3.23	65.23	65.89

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message
	Warning: Pipe does not meet minimum slope constraint.

Detailed Report for Pipe: P-2

Message List	
Time (hr)	Message
	Warning: Pipe discharge is above full flow capacity.
	Warning: Pipe discharge is above design capacity.

Detailed Report for Pipe: P-3

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics				
Upstream Node	I-32.3		Number of Sections	1
Downstream Node	I-3.2.2		Section Shape	Circular
Bend Angle	61.01	degrees	Section Size	18 inch
Length	92.00	ft	Material	CMP
Constructed Slope	0.010870	ft/ft	Mannings n	0.024

Hydraulic Summary				
Total System Flow	34.00	cfs	Full Capacity	5.93 cfs
Profile Description	Pressure		Energy Slope	0.357111 ft/ft
Gravity Element Headloss	32.85	ft	Velocity In	19.24 ft/s
Average Velocity	19.24	ft/s	Velocity Out	19.24 ft/s
Constructed Slope	0.010870	ft/ft	Design Capacity	5.93 cfs
Excess Full Capacity	-28.07	cfs	Excess Design Capacity	-28.07 cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	64.00	69.00	65.50	3.50	36.47	100.47	106.23
Downstrear	63.00	68.00	64.50	3.50	4.62	67.62	73.37

Pipe Design Options				
Design Pipe?	false		Design Upstream Invert?	false
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false
Part Full Design?	false		Design Percent Full	N/A %
Allow Multiple Sections?	false		Maximum Number Sections	N/A
Limit Section Size?	false		Maximum Section Rise	N/A in

Pipe Design Constraints				
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00 ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00 ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000 ft/ft

User Data
Date Installed

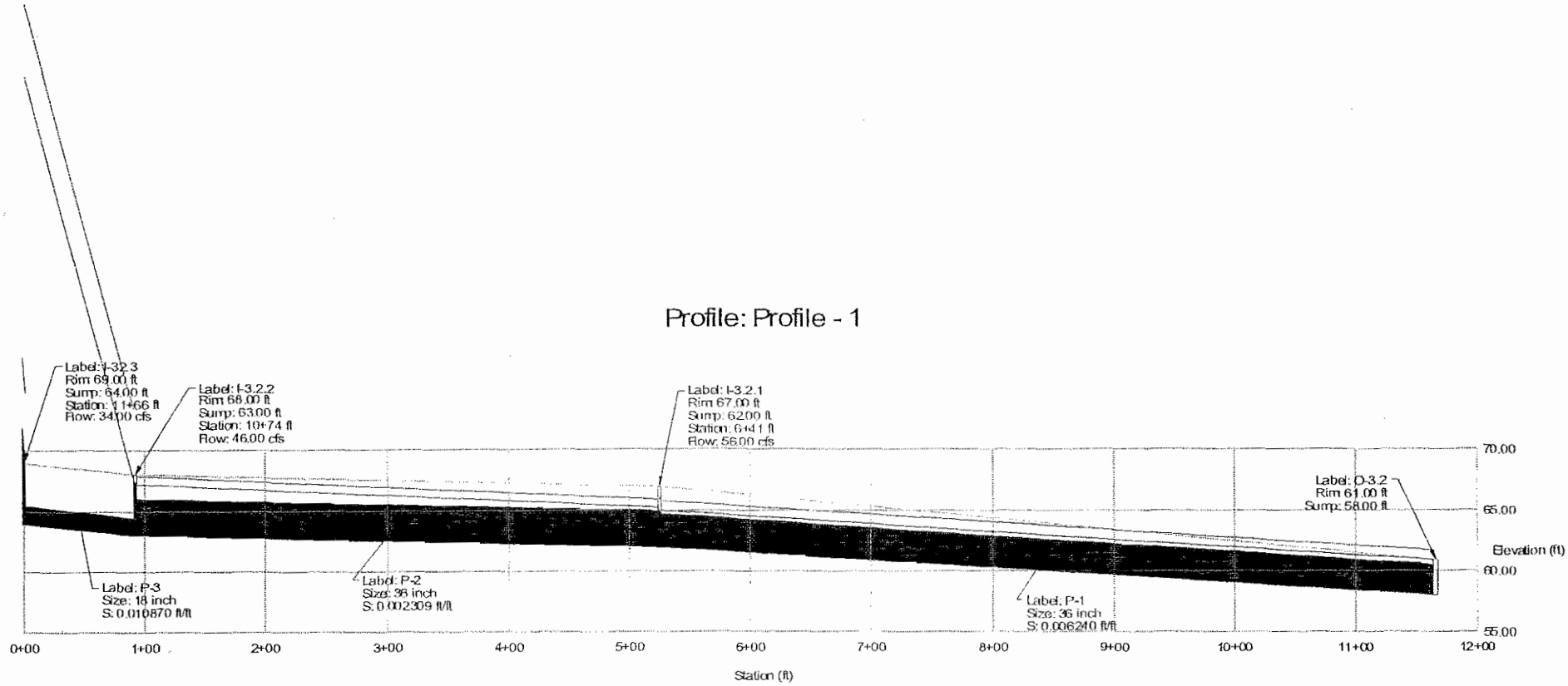
Message List

Time (hr)	Message
	Warning: Pipe does not meet maximum velocity constraint.

Detailed Report for Pipe: P-3

Message List	
Time (hr)	Message
	Warning: Pipe discharge is above full flow capacity.
	Warning: Pipe discharge is above design capacity.

rofile
Scenario: Base



Worksheet for Nodes 3.3 & 3.4

Project Description		
Flow Element:	Elliptical Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.024	
Channel Slope:	0.01500	ft/ft
Normal Depth:	3.00	ft
Rise:	3.00	ft
Span:	4.83	ft

Results		
Discharge:	81.26	ft^3/s
Flow Area:	11.38	ft^2
Wetted Perimeter:	12.46	ft
Top Width:	0.00	ft
Critical Depth:	2.31	ft
Percent Full:	100.0	%
Critical Slope:	0.01579	ft/ft
Velocity:	7.14	ft/s
Velocity Head:	0.79	ft
Specific Energy:	3.79	ft
Froude Number:	0.00	
Max Discharge:	88.67	ft^3/s
Discharge Full:	81.20	ft^3/s
Slope Full:	0.01498	ft/ft
Flow Type:	Subcritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%

Worksheet for Nodes 3.3 & 3.4

Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	3.00	ft
Critical Depth:	2.31	ft
Channel Slope:	0.01500	ft/ft
Critical Slope:	0.01579	ft/ft

Worksheet for Nodes 4.3 & 4.5

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.00500	ft/ft
Normal Depth:	12.00	ft
Bottom Width:	24.00	ft

Results		
Discharge:	7685.94	ft^3/s
Flow Area:	288.00	ft^2
Wetted Perimeter:	48.00	ft
Top Width:	24.00	ft
Critical Depth:	14.72	ft
Critical Slope:	0.00292	ft/ft
Velocity:	26.69	ft/s
Velocity Head:	11.07	ft
Specific Energy:	23.07	ft
Froude Number:	1.36	
Flow Type:	Supercritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	12.00	ft
Critical Depth:	14.72	ft
Channel Slope:	0.00500	ft/ft
Critical Slope:	0.00292	ft/ft

Detailed Report for Inlet: I-4.5.2

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	80,411.49	ft	Calculated Station	9+10 ft
Y	223,739.78	ft		

Elevations				
Ground Elevation	68.43	ft	Hydraulic Grade Line In	84.76 ft
Rim Elevation	68.43	ft	Hydraulic Grade Line Out	68.43 ft
Sump Elevation	61.43	ft		

Headlosses				
Gravity Element Headloss	16.33	ft	Depth Out	7.00 ft
Headloss Method	Standard		Velocity Out	45.84 ft/s
Headloss Coefficient	0.50		Velocity Head Out	32.65 ft

System Flow Summary				
Total System Flow	36.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	0.00	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	36.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

External Pipe Flow				
External CA	0.00	acres	External Time of Concentration	0.00 min

Detailed Report for Inlet: I-4.5.2

Intercepted Flow Summary					
Intercepted Rational Flow	0.00	cfs	Intercepted CA	0.00	acres
Intercepted Additional Flow	0.00	cfs	Intercepted Intensity	0.00	in/hr
Intercepted Known Flow	0.00	cfs	Intercepted Tc	0.00	min
Total Intercepted Flow	0.00	cfs	Capture Efficiency	100.0	%

Upstream Piped Flow Summary					
Upstream Rational Flow	0.00	cfs	Upstream CA	0.00	acres
Upstream Additional Flow	0.00	cfs	Upstream Intensity	0.00	in/hr
Upstream Known Flow	0.00	cfs	Upstream Time Of Concentration	0.00	min
Total Upstream Flow	0.00	cfs			

Design Constraints Summary					
Pipe Matching	Inverts		Allow Drop Structure?	true	
Matchline Offset	0.00	ft	Local Pipe Matching Constraints?	false	
Design Structure Elevation?	false		Desired Sump Depth	0.00	ft

User Data
Date Installed

Message List

Time (hr)	Message
	Warning: Structure is flooded.

Detailed Report for Outlet: O-4.5.1

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary			
X	80,424.93 ft	Station	0+00 ft
Y	222,829.38 ft		

Elevations			
Ground Elevation	50.00 ft	Sump Elevation	41.00 ft
Rim Elevation	50.00 ft		

Tailwater Hydraulics			
Tailwater Condition	Free Outfall	Hydraulic Grade Line Out	41.00 ft

System Flow Summary			
Total System Flow	36.00 cfs	System Rational Flow	0.00 cfs
System Flow Time	0.33 min	System Known Flow	36.00 cfs
System Intensity	0.00 in/hr	System Additional Flow	0.00 cfs
System CA	0.00 acres	Total Lost Surface Flow	0.00 cfs
Total Diverted Flow In	0.00 cfs		

Incoming Diverted Flow			
Local Diverted Flow In	0.00 cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Pipe: P-6

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics				
Upstream Node	I-4.5.2		Number of Sections	1
Downstream Node	O-4.5.1		Section Shape	Circular
Bend Angle	0.00	degrees	Section Size	12 inch
Length	910.00	ft	Material	CMP
Constructed Slope	0.022451	ft/ft	Mannings n	0.024

Hydraulic Summary					
Total System Flow	36.00	cfs	Full Capacity	2.89	cfs
Profile Description	Pressure		Energy Slope	3.480199	ft/ft
Gravity Element Headloss	3,166.98	ft	Velocity In	45.84	ft/s
Average Velocity	45.84	ft/s	Velocity Out	45.84	ft/s
Constructed Slope	0.022451	ft/ft	Design Capacity	2.89	cfs
Excess Full Capacity	-33.11	cfs	Excess Design Capacity	-33.11	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	61.43	68.43	62.43	6.00	3,147.55	3,208.98	3,241.63
Downstrear	41.00	50.00	42.00	8.00	1.00	42.00	74.65

Pipe Design Options				
Design Pipe?	false		Design Upstream Invert?	false
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false
Part Full Design?	false		Design Percent Full	N/A %
Allow Multiple Sections?	false		Maximum Number Sections	N/A
Limit Section Size?	false		Maximum Section Rise	N/A in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

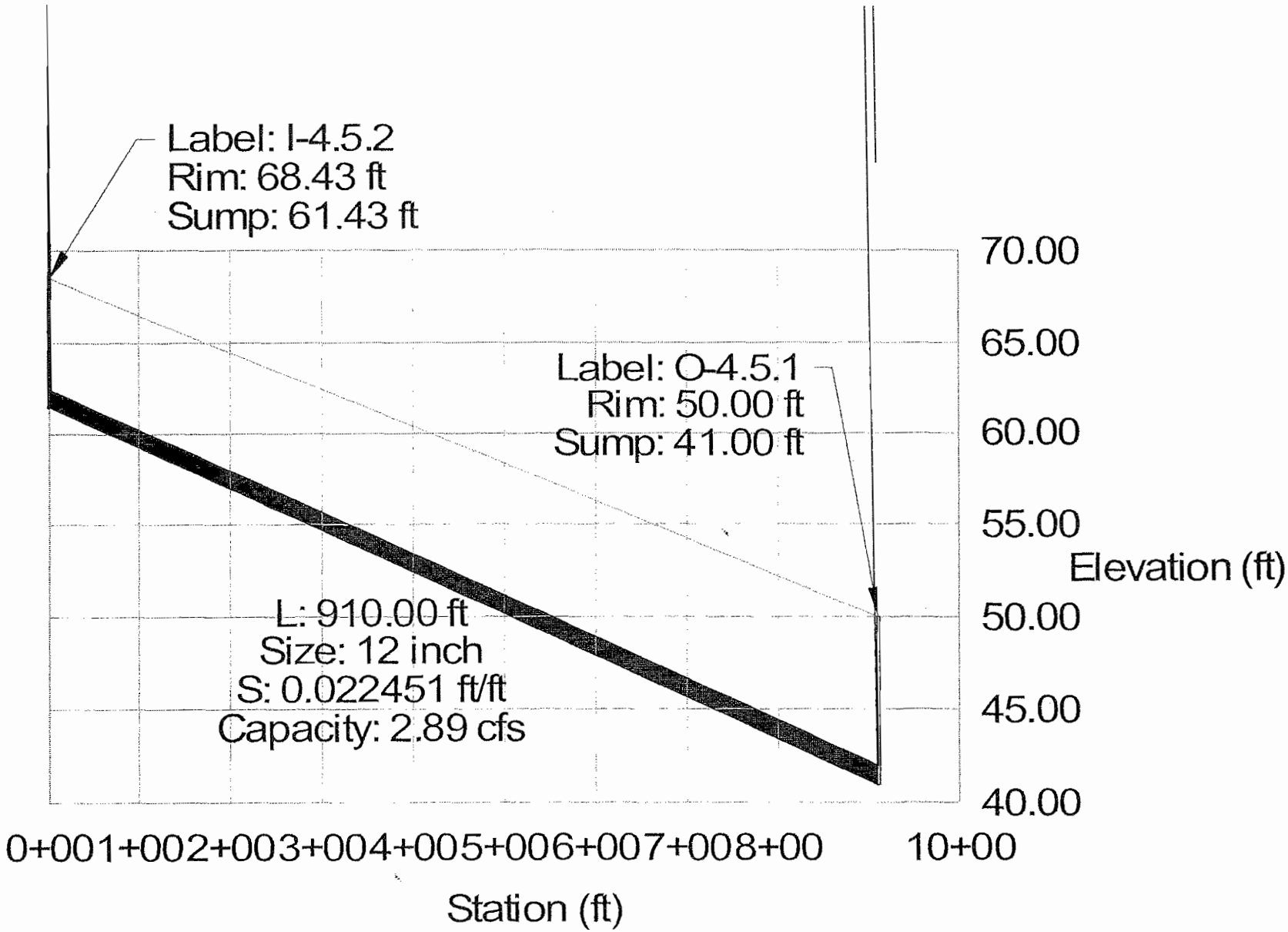
Message List

Time (hr)	Message
	Warning: Pipe does not meet maximum velocity constraint.

Detailed Report for Pipe: P-6

Message List	
Time (hr)	Message
	Warning: Pipe discharge is above full flow capacity.
	Warning: Pipe discharge is above design capacity.

rofile
Scenario: Base



Detailed Report for Inlet: I-4.5.2

Scenario Summary	
Scenario	Improvements
Physical Properties Alternative	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-Improvements
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	80,411.49	ft	Calculated Station	9+10 ft
Y	223,739.78	ft		

Elevations				
Ground Elevation	68.43	ft	Hydraulic Grade Line In	64.40 ft
Rim Elevation	68.43	ft	Hydraulic Grade Line Out	63.36 ft
Sump Elevation	61.43	ft		

Headlosses				
Gravity Element Headloss	1.04	ft	Depth Out	1.93 ft
Headloss Method	Standard		Velocity Out	11.59 ft/s
Headloss Coefficient	0.50		Velocity Head Out	2.09 ft

System Flow Summary				
Total System Flow	36.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	0.00	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	36.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

External Pipe Flow				
External CA	0.00	acres	External Time of Concentration	0.00 min

Detailed Report for Inlet: I-4.5.2

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	0.00 cfs	Upstream Time Of Concentration	0.00 min
Total Upstream Flow	0.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Outlet: O-4.5.1

Scenario Summary	
Scenario	Improvements
Physical Properties Alternative	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-improvements
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary			
X	80,424.93 ft	Station	0+00 ft
Y	222,829.38 ft		

Elevations			
Ground Elevation	50.00 ft	Sump Elevation	41.00 ft
Rim Elevation	50.00 ft		

Tailwater Hydraulics			
Tailwater Condition	Free Outfall	Hydraulic Grade Line Out	41.00 ft

System Flow Summary			
Total System Flow	36.00 cfs	System Rational Flow	0.00 cfs
System Flow Time	1.14 min	System Known Flow	36.00 cfs
System Intensity	0.00 in/hr	System Additional Flow	0.00 cfs
System CA	0.00 acres	Total Lost Surface Flow	0.00 cfs
Total Diverted Flow In	0.00 cfs		

Incoming Diverted Flow			
Local Diverted Flow In	0.00 cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Pipe: P-6

Scenario Summary	
Scenario	Improvements
Physical Properties Alternative	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-Improvements
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-4.5.2		Number of Sections	1	
Downstream Node	O-4.5.1		Section Shape	Circular	
Bend Angle	0.00	degrees	Section Size	24 inch	
Length	910.00	ft	Material	Corrugated HDPE (Smooth Interior)	
Constructed Slope	0.022451	ft/ft	Mannings n	0.012	

Hydraulic Summary					
Total System Flow	36.00	cfs	Full Capacity	36.72	cfs
Profile Description	S2		Energy Slope	0.022069	ft/ft
Gravity Element Headloss	20.75	ft	Velocity In	11.59	ft/s
Average Velocity	13.32	ft/s	Velocity Out	13.32	ft/s
Constructed Slope	0.022451	ft/ft	Design Capacity	36.72	cfs
Excess Full Capacity	0.72	cfs	Excess Design Capacity	0.72	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	61.43	68.43	63.43	5.00	1.93	63.36	65.45
Downstrear	41.00	50.00	43.00	7.00	1.60	42.60	45.36

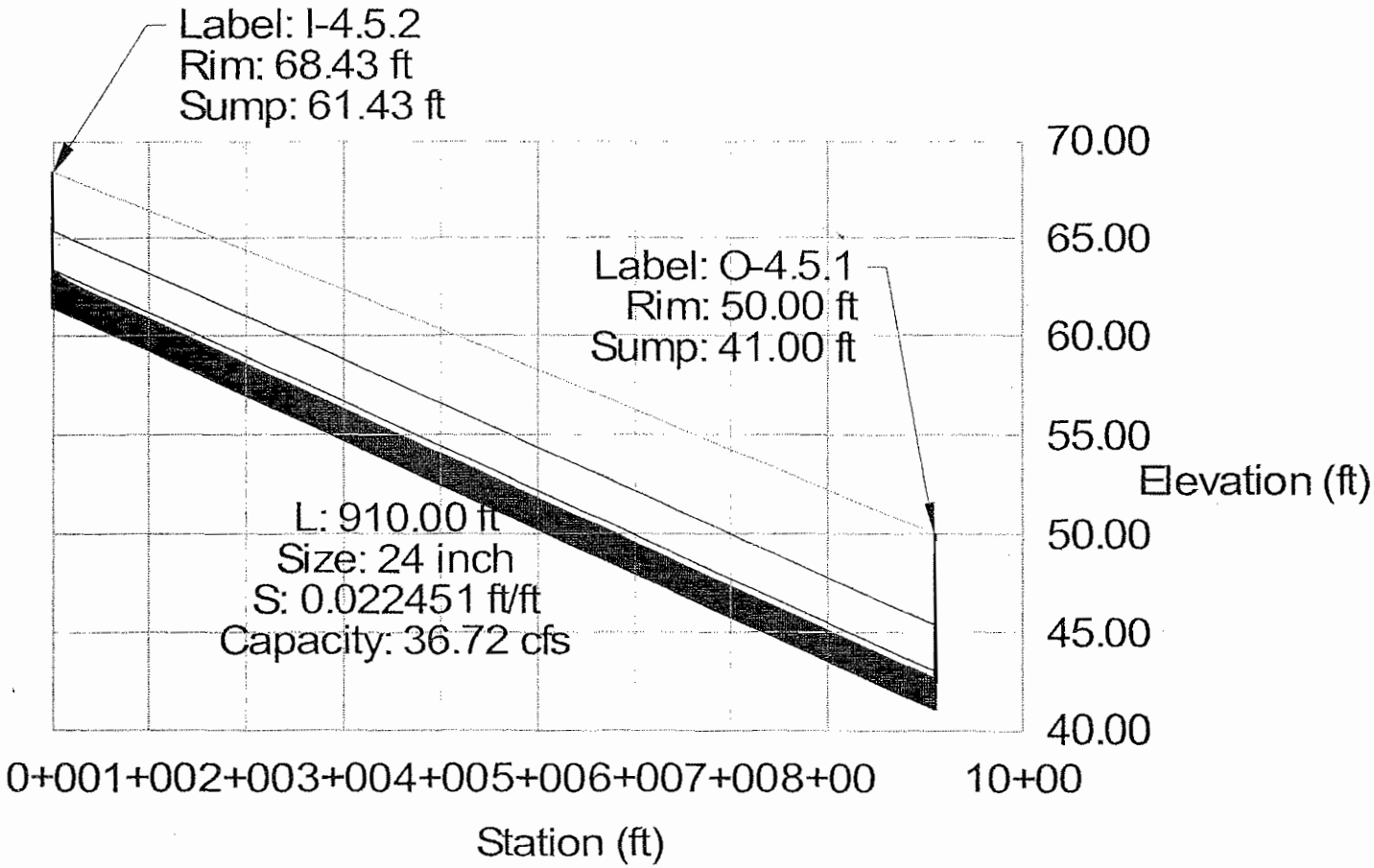
Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Profile: Profile - 2

Scenario: Improvements



Analysis Results
Scenario: Base

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	5	Number of Inlets	5
- Circular Pipes:	5	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	5
Number of Outlets	1		

Circular Pipes Inventory			
12 inch	1,194.00 ft	24 inch	202.00 ft
Total Length	1,396.00 ft		

Generic Inlet Inventory	
Default 100%	5

Inlet elements for network with outlet: O-4.8.1

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
I-3	Generic Default 1	20.00	0.00	0.00	N/A	100.0	57.20	56.78	0.42	Standar
I-4.8.2	Generic Default 1	20.00	0.00	0.00	N/A	100.0	57.84	57.53	0.31	Standar
I-4.8.3	Generic Default 1	20.00	0.00	0.00	N/A	100.0	58.90	58.58	0.31	Standar
I-4.8.4	Generic Default 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Standar
I-4.8.5	Generic Default 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Standar

Outlet: O-4.8.1

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)

Analysis Results
Scenario: Base

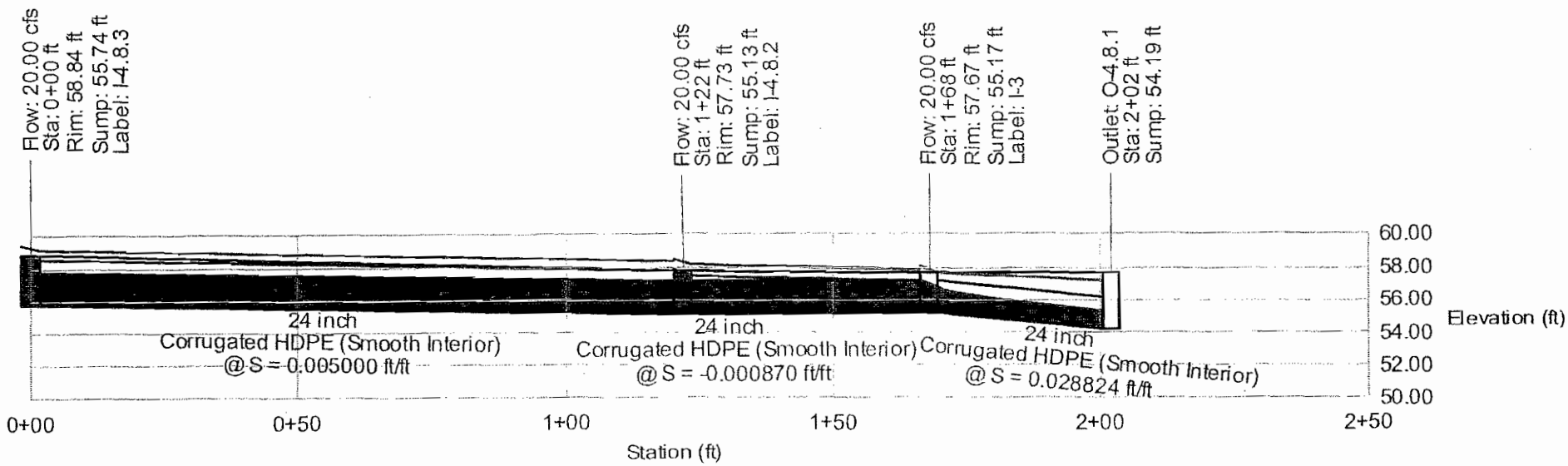
Outlet: O-4.8.1

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
O-4.8.1	54.19	54.19	0.00	0.00	20.00	0.00	0.00	0.50	0.00

Pipe elements for network with outlet: O-4.8.1

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Circular	24 inch	22.00	1	0.005000	006660	20.00	6.37	57.74	57.13	58.58	57.73
P-2	Circular	24 inch	46.00	1	0.042609	006660	20.00	6.37	57.13	55.17	57.53	57.20
P-3	Circular	24 inch	34.00	1	0.028824	013720	20.00	13.57	55.17	54.19	56.78	55.31
P-4	Circular	12 inch	87.00	1	0.000000	N/A	N/A	N/A	0.00	0.00	N/A	N/A
P-5	Circular	12 inch	07.00	1	0.000000	N/A	N/A	N/A	0.00	0.00	N/A	N/A

Profile: Base Profile



Analysis Results
Scenario: Improvements

Title: Springville, Shamrock to Redwood Way
Project Engineer: Matthew Kennedy
Project Date: 05/02/05
Comments: City Project No. 9703

Scenario Summary	
Scenario	Improvements
Physical Properties Alternat	Physical Properties-Improvements
Catchments Alternative	Catchments-Improvements
System Flows Alternative	System Flows-Improvements
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	5	Number of Inlets	5
- Circular Pipes:	5	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	0	- Generic Inlets:	5
Number of Outlets	1		

Circular Pipes Inventory	
24 inch	1,396.00 ft
Total Length	1,396.00 ft

Generic Inlet Inventory	
Default 100%	5

Inlet elements for network with outlet: O-4.8.1

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
I-3	Generic Default 1	20.00	0.00	0.00	N/A	100.0	56.53	56.11	0.42	Standar
I-4.8.2	Generic Default 1	20.00	0.00	0.00	N/A	100.0	57.03	56.61	0.42	Standar
I-4.8.3	Generic Default 1	20.00	0.00	0.00	N/A	100.0	58.03	57.61	0.42	Standar
I-4.8.4	Generic Default 1	20.00	0.00	0.00	N/A	100.0	60.51	60.20	0.31	Standar
I-4.8.5	Generic Default 1	12.00	0.00	0.00	N/A	100.0	63.56	63.33	0.23	Standar

Outlet: O-4.8.1

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
O-4.8.1	54.19	54.19	0.00	0.00	20.00	0.00	0.00	3.87	0.00

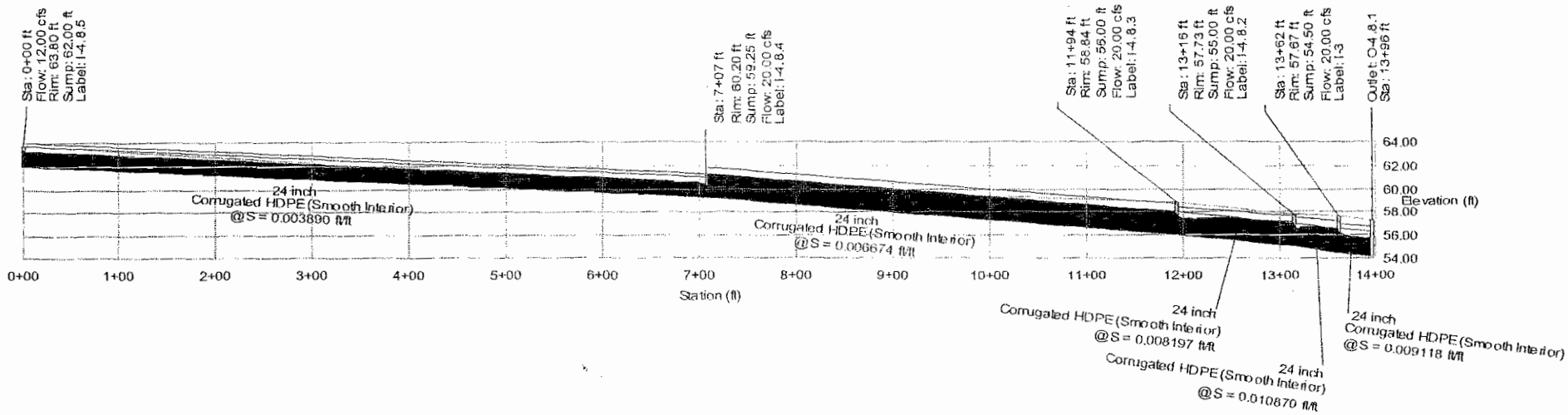
Analysis Results
Scenario: Improvements

Pipe elements for network with outlet: O-4.8.1

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Circular	24 inch	22.00	1	0.008197	006518	20.00	7.99	56.00	55.00	57.61	57.03
P-2	Circular	24 inch	46.00	1	0.010870	006417	20.00	9.00	55.00	54.50	56.61	56.53
P-3	Circular	24 inch	34.00	1	0.009118	008089	20.00	8.37	54.50	54.19	56.11	55.65
P-4	Circular	24 inch	87.00	1	0.006674	006660	20.00	6.37	59.25	56.00	61.27	58.03
P-5	Circular	24 inch	07.00	1	0.003890	003906	12.00	5.39	62.00	59.25	63.33	60.49

ofile
Scenario: Improvements

Profile: Improvement Profile



Analysis Results
Scenario: Base

Outlet: O-1.3

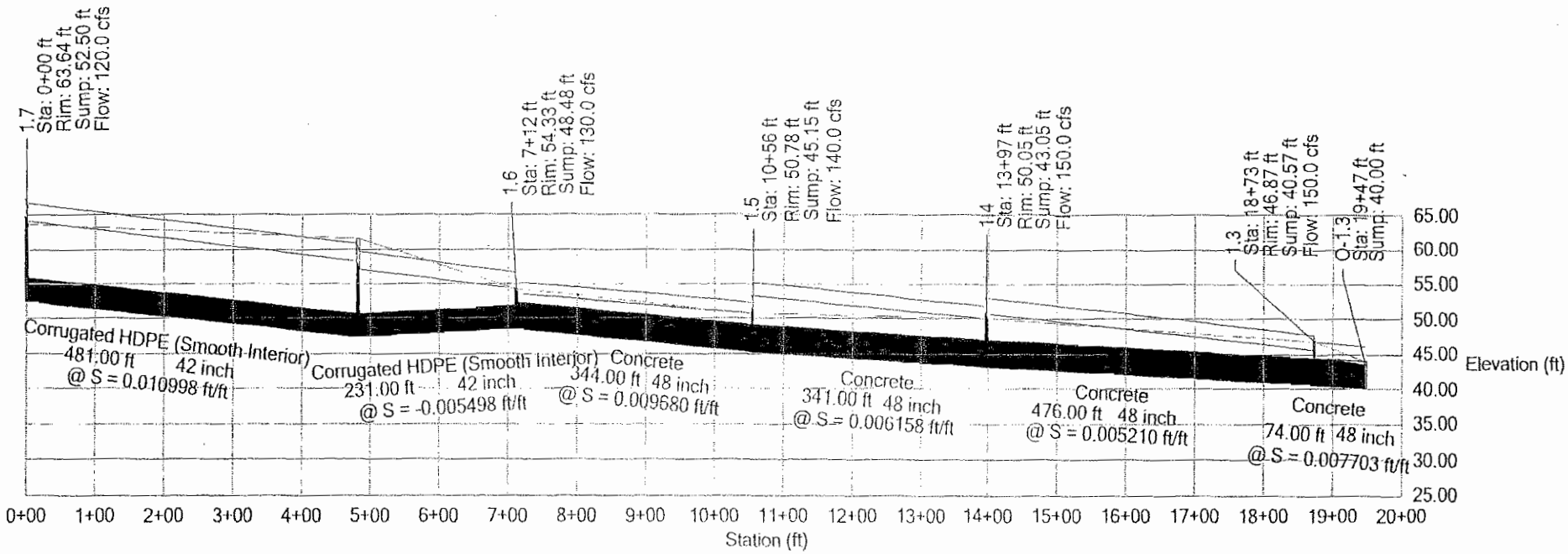
Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
O-1.3	40.00	40.00	0.00	0.0	150.0	0.0	0.00	3.89	0.00

Pipe elements for network with outlet: O-1.3

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Circular	48 inch	74.00	1	0.007703	009813	150.0	11.94	40.57	40.00	44.58	43.60
P-2	Circular	48 inch	76.00	1	0.005210	010906	150.0	11.94	43.05	40.57	50.87	45.68
P-3	Circular	48 inch	141.00	1	0.006158	009500	140.0	11.14	45.15	43.05	53.29	50.05
P-8	Circular	48 inch	144.00	1	0.009680	008191	130.0	10.35	48.48	45.15	53.60	50.78
P-10	Circular	42 inch	131.00	1	-0.005498	012123	120.0	12.47	47.21	48.48	57.13	54.33
P-11	Circular	42 inch	81.00	1	0.010998	012123	120.0	12.47	52.50	47.21	64.17	58.34

Profile: Profile - 2

Scenario: Base



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	10	Number of Inlets	9
- Circular Pipes:	10	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	1	- Generic Inlets:	9
Number of Outlets	1		

Circular Pipes Inventory				
18 inch	577.00	ft	42 inch	712.00 ft
24 inch	2,153.00	ft	48 inch	1,235.00 ft
30 inch	780.00	ft		
Total Length	5,457.00	ft		

Generic Inlet Inventory	
Default 100%	9

Inlet elements for network with outlet: O-1.3

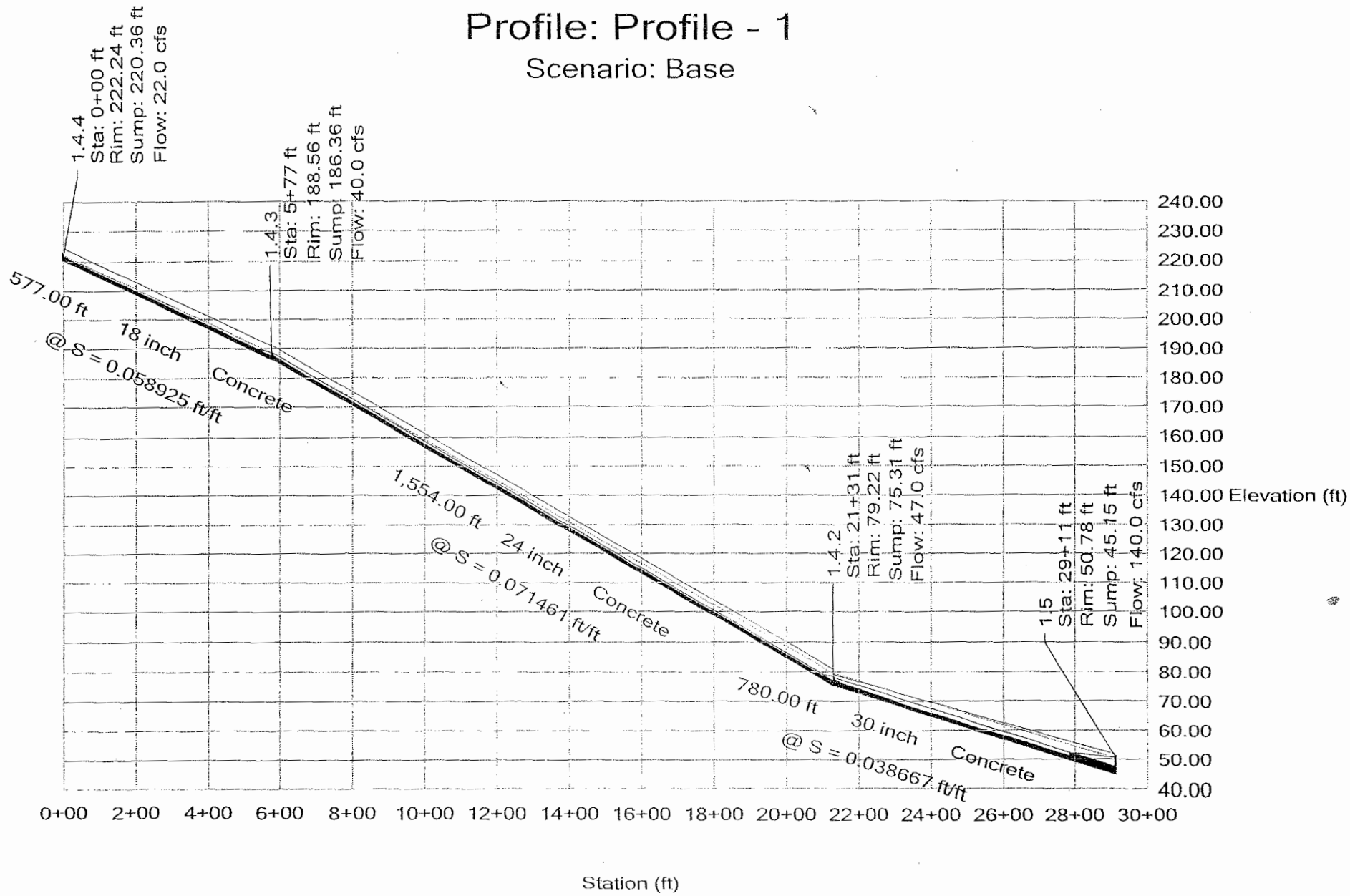
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.4.2	Generic Default 1	47.0	0.0	0.0	N/A	100.0	78.36	77.57	0.79	Standar
1.4.3	Generic Default 1	40.0	0.0	0.0	N/A	100.0	189.59	188.31	1.28	Standar
1.4.4	Generic Default 1	22.0	0.0	0.0	N/A	100.0	223.05	221.84	1.21	Standar
1.5	Generic Default 1	140.0	0.0	0.0	N/A	100.0	51.74	50.78	0.96	Standar

Pipe elements for network with outlet: O-1.3

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-4	Circular	30 inch	780.00	1	0.038667	034539	47.0	17.06	75.31	45.15	77.57	50.78
P-5	Circular	24 inch	,554.00	1	0.071461	070777	40.0	20.57	186.36	75.31	188.31	78.36
P-6	Circular	18 inch	577.00	1	0.058925	057699	22.0	16.23	220.36	186.36	221.84	188.56

Profile: Profile - 1

Scenario: Base



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	10	Number of Inlets	9
- Circular Pipes:	10	- Grate Inlets:	0
- Box Pipes:	0	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	1	- Generic Inlets:	9
Number of Outlets	1		

Circular Pipes Inventory			
18 inch	577.00 ft	42 inch	712.00 ft
24 inch	2,153.00 ft	48 inch	1,235.00 ft
30 inch	780.00 ft		
Total Length	5,457.00 ft		

Generic Inlet Inventory	
Default 100%	9

Inlet elements for network with outlet: O-1.3

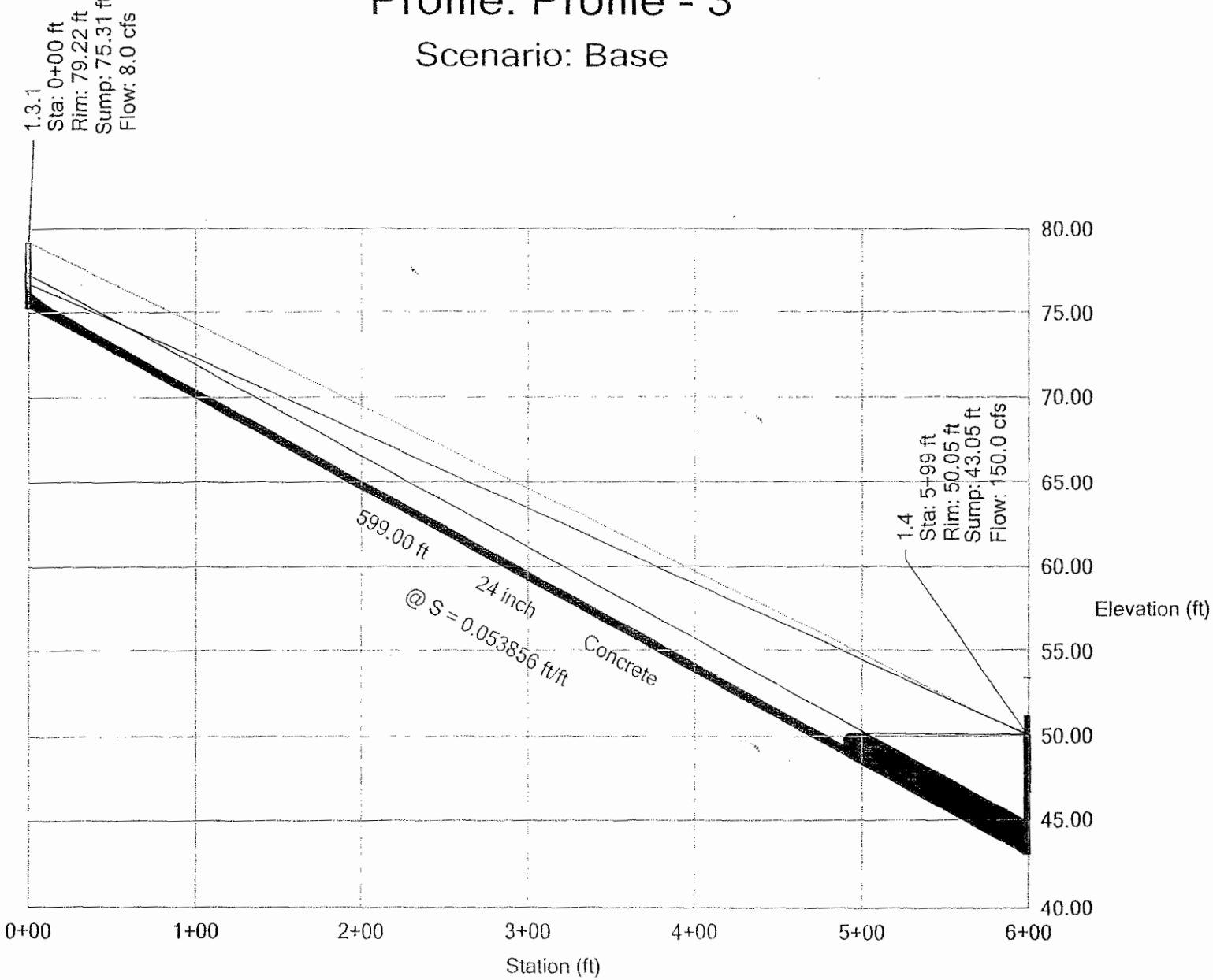
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.3.1	Generic Default 1	8.0	0.0	0.0	N/A	100.0	76.51	76.32	0.20	Standar
1.4	Generic Default 1	150.0	0.0	0.0	N/A	100.0	51.16	50.05	1.11	Standar

Pipe elements for network with outlet: O-1.3

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-12	Circular	24 inch	99.00	1	0.053856	044344	8.0	12.07	75.31	43.05	76.32	50.05

Profile: Profile - 3

Scenario: Base



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Altern	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	6
- Circular Pipes:	7	- Grate Inlets:	0
- Box Pipes:	1	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	2	- Generic Inlets:	6
Number of Outlets	2		

Circular Pipes Inventory			
14 inch	132.00 ft	30 inch	335.00 ft
16 inch	261.00 ft	48 inch	484.00 ft
18 inch	2,110.00 ft		
Total Length	3,322.00 ft		

Box Pipes Inventory	
3 x 3 ft	433.00 ft
Total Length	433.00 ft

Generic Inlet Inventory	
Default 100%	6

Outlet: 1.5

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
1.5	54.43	54.43	0.00	0.00	15.00	0.00	0.00	0.64	0.00

Inlet elements for network with outlet: 1.5

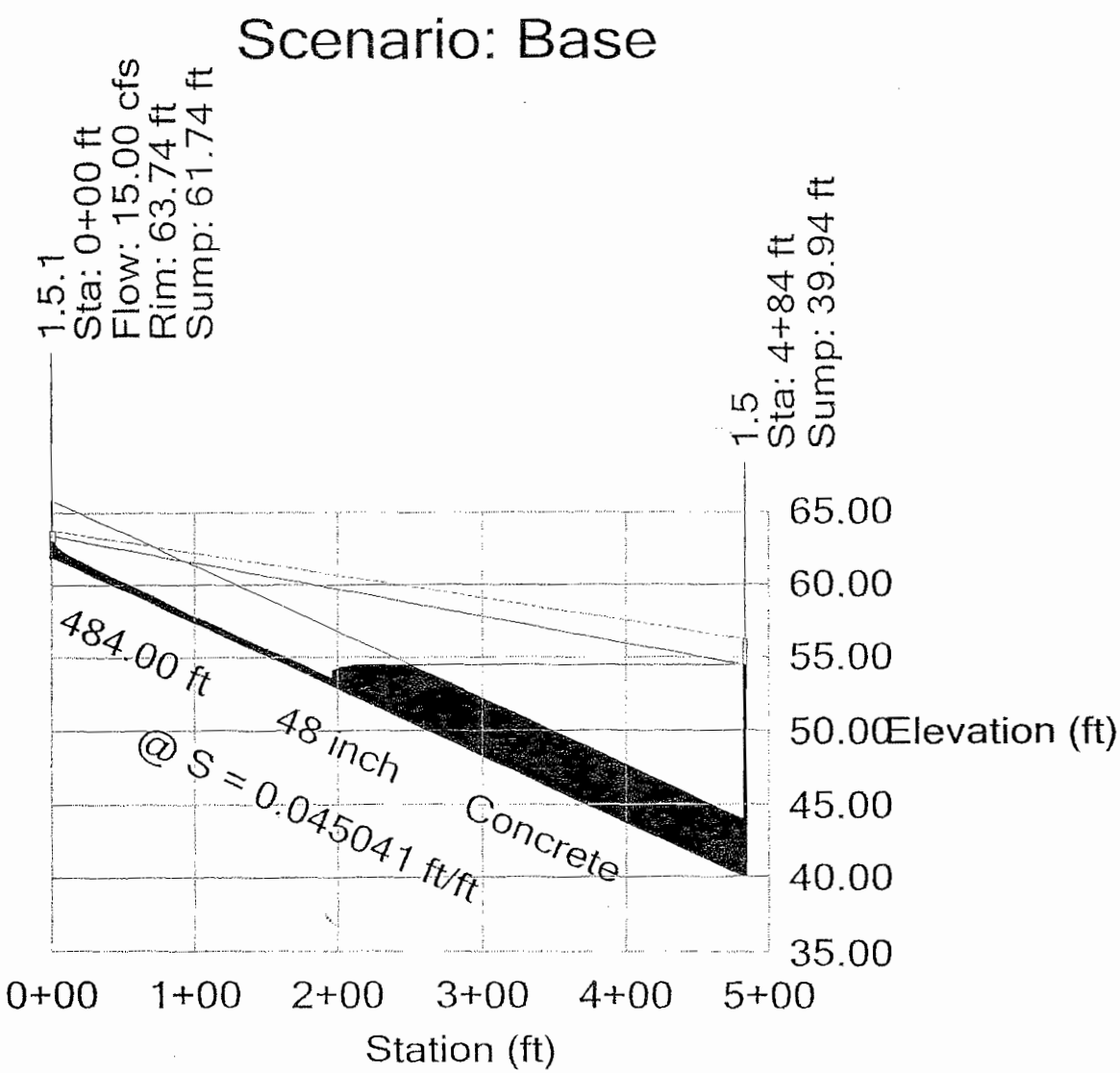
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.5.1	Generic Default 1	15.00	0.00	0.00	N/A	100.0	63.08	62.87	0.20	Standar

Analysis Results
Scenario: Base

Pipe elements for network with outlet: 1.5

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1	Circular	48 inch	84.00	1	0.045041	018242	15.00	12.58	61.74	39.94	62.87	54.43

Profile: Profile - 1



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary

Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory

Number of Pipes	8	Number of Inlets	6
- Circular Pipes:	7	- Grate Inlets:	0
- Box Pipes:	1	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	2	- Generic Inlets:	6
Number of Outlets	2		

Circular Pipes Inventory

14 inch	132.00 ft	30 inch	335.00 ft
16 inch	261.00 ft	48 inch	484.00 ft
18 inch	2,110.00 ft		
Total Length	3,322.00 ft		

Box Pipes Inventory

3 x 3 ft	433.00 ft
Total Length	433.00 ft

Generic Inlet Inventory

Default 100%	6

Outlet: 1.6

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
1.6	64.85	64.85	0.00	0.00	14.00	0.00	0.00	1.28	0.00

Inlet elements for network with outlet: 1.6

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.6.1	Generic Default 1	30.00	0.00	0.00	N/A	100.0	71.03	64.91	6.12	Standar

Analysis Results
Scenario: Base

Inlet elements for network with outlet: 1.6

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.6.2	Generic Default 1	16.00	0.00	0.00	N/A	100.0	74.16	73.52	0.64	Standar

Junction elements for network with outlet: 1.6

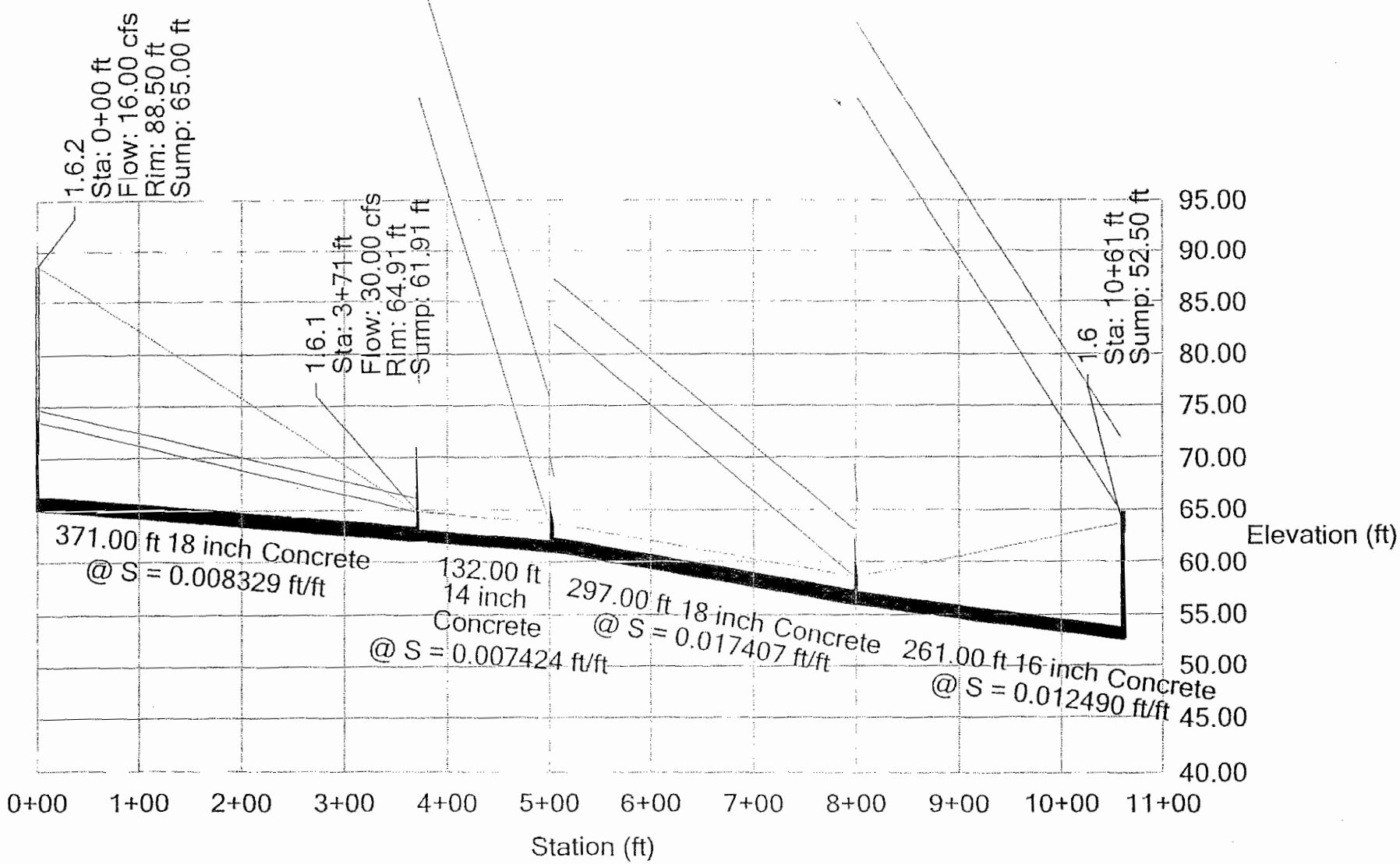
Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
J-1	62.18	58.59	3.59	Standar	0.00	30.00	0.00	0.00	1.05	0.00
J-2	65.92	63.68	2.24	Standar	0.00	30.00	0.00	0.00	0.76	0.00

Pipe elements for network with outlet: 1.6

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-6	Circular	18 inch	71.00	1	0.008329	023203	16.00	9.05	65.00	61.91	73.52	64.91
P-8	Circular	16 inch	61.00	1	0.012490	152885	30.00	21.49	55.76	52.50	104.75	64.85
P-9	Circular	14 inch	32.00	1	0.007424	311642	30.00	28.06	61.91	60.93	104.82	63.68
P-10	Circular	18 inch	97.00	1	0.017407	081574	30.00	16.98	60.93	55.76	82.82	58.59

Profile: Profile - 3

Scenario: Base



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	6
- Circular Pipes:	7	- Grate Inlets:	0
- Box Pipes:	1	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	2	- Generic Inlets:	6
Number of Outlets	2		

Circular Pipes Inventory			
14 inch	132.00 ft	30 inch	335.00 ft
16 inch	261.00 ft	48 inch	484.00 ft
18 inch	2,110.00 ft		
Total Length	3,322.00 ft		

Box Pipes Inventory	
3 x 3 ft	433.00 ft
Total Length	433.00 ft

Generic Inlet Inventory	
Default 100%	6

Outlet: 1.6

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
1.6	64.85	64.85	0.00	0.00	14.00	0.00	0.00	1.28	0.00

Inlet elements for network with outlet: 1.6

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.7	Generic Default 1	84.00	0.00	0.00	N/A	100.0	67.05	66.37	0.68	Standa

Analysis Results
Scenario: Base

Inlet elements for network with outlet: 1.6

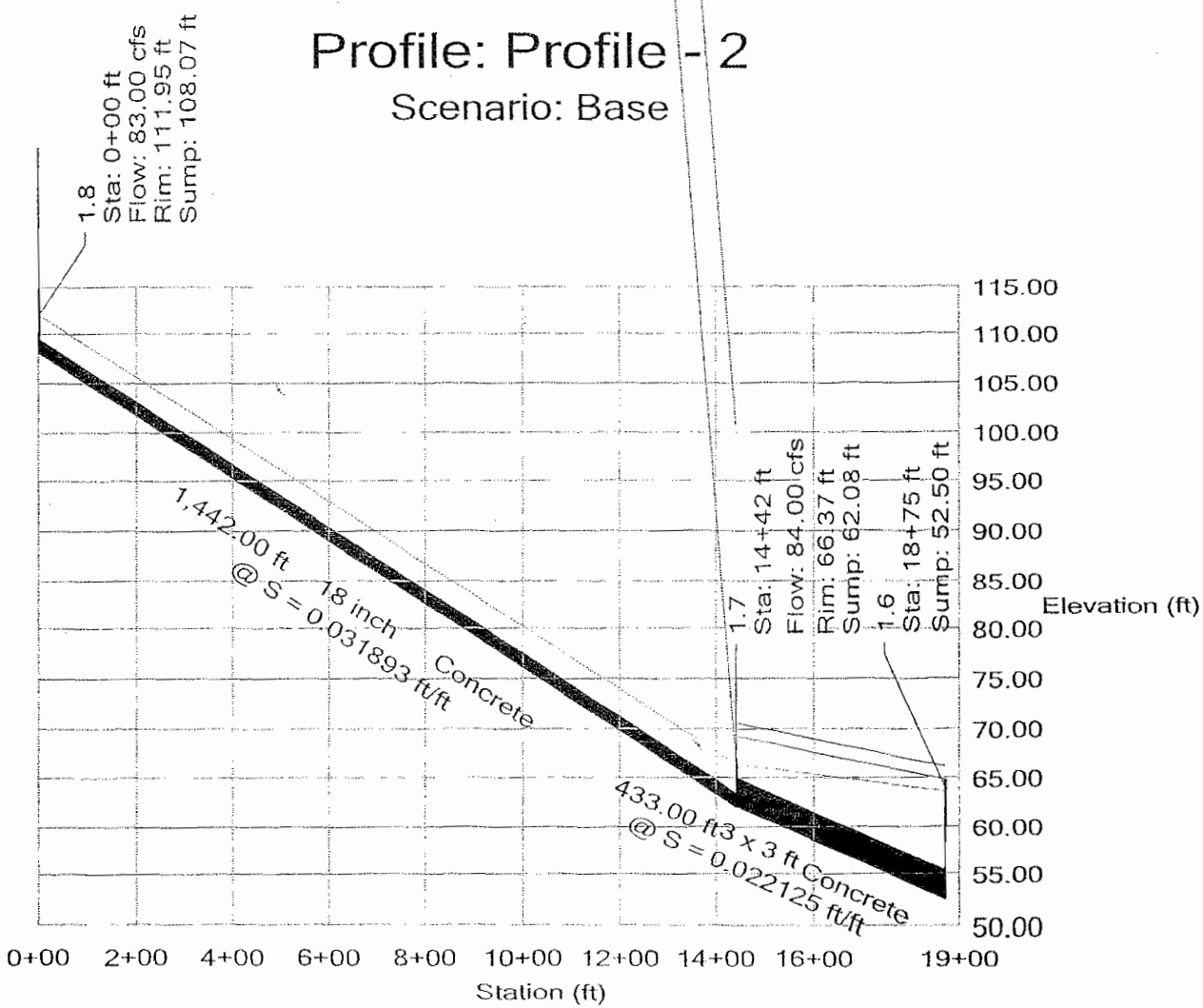
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.8	Generic Default 1	83.00	0.00	0.00	N/A	100.0	129.09	111.95	17.14	Standar

Pipe elements for network with outlet: 1.6

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-2	Box	3 x 3 ft	433.00	1	0.022125	009785	84.00	9.33	62.08	52.50	69.09	64.85
P-3	Circular	18 inch	,442.00	1	0.031893	624405	83.00	46.97	108.07	62.08	966.76	66.37

Profile: Profile - 2

Scenario: Base



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	6
- Circular Pipes:	7	- Grate Inlets:	0
- Box Pipes:	1	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	2	- Generic Inlets:	6
Number of Outlets	2		

Circular Pipes Inventory			
14 inch	132.00 ft	30 inch	335.00 ft
16 inch	261.00 ft	48 inch	484.00 ft
18 inch	2,110.00 ft		
Total Length	3,322.00 ft		

Box Pipes Inventory	
3 x 3 ft	433.00 ft
Total Length	433.00 ft

Generic Inlet Inventory	
Default 100%	6

Inlet elements for network with outlet: 1.6

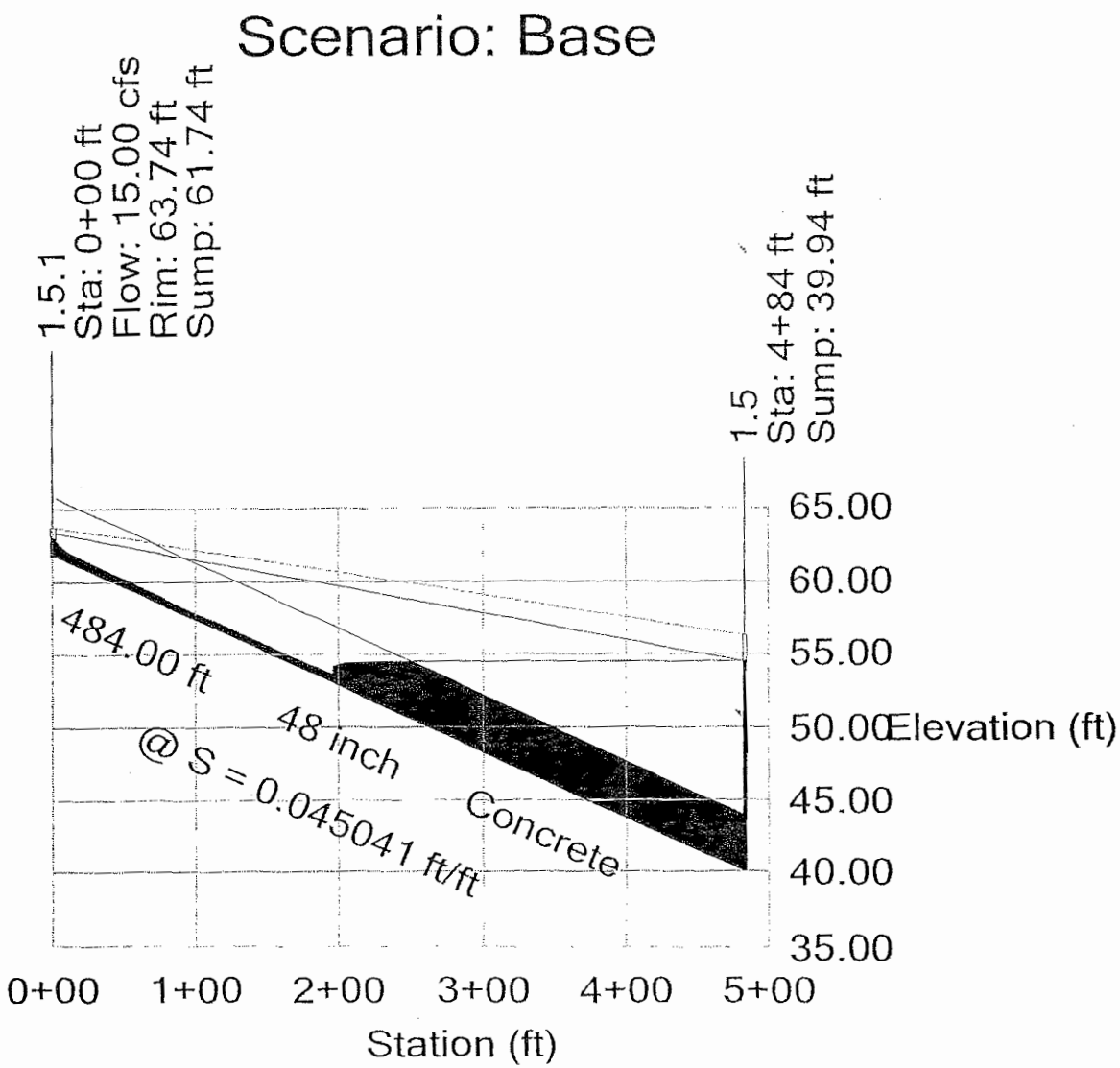
Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.7	Generic Default 1	84.00	0.00	0.00	N/A	100.0	67.05	66.37	0.68	Standar
1.7.1	Generic Default 1	47.00	0.00	0.00	N/A	100.0	86.65	85.86	0.79	Standar

Analysis Results
Scenario: Base

Pipe elements for network with outlet: 1.6

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-4	Circular	30 inch	35.00	1	0.064239	058629	47.00	20.64	83.60	62.08	85.86	66.37

Profile: Profile - 1



Analysis Results
Scenario: Base

Title: North Fortuna Drainage
Project Engineer: Matthew Kennedy
Project Date: 04/29/05
Comments:

Scenario Summary	
Scenario	Base
Physical Properties Alternat	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alterr	Base-Structure Headlosses
Boundary Conditions Altern	Base-Boundary Conditions
Design Constraints Alternat	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Network Inventory			
Number of Pipes	8	Number of Inlets	6
- Circular Pipes:	7	- Grate Inlets:	0
- Box Pipes:	1	- Curb Inlets:	0
- Arch Pipes:	0	- Combination Inlets:	0
- Vertical Elliptical Pipes:	0	- Slot Inlets:	0
- Horizontal Elliptical Pipes:	0	- Grate Inlets in Ditch:	0
Number of Junctions	2	- Generic Inlets:	6
Number of Outlets	2		

Circular Pipes Inventory			
14 inch	132.00 ft	30 inch	335.00 ft
16 inch	261.00 ft	48 inch	484.00 ft
18 inch	2,110.00 ft		
Total Length	3,322.00 ft		

Box Pipes Inventory	
3 x 3 ft	433.00 ft
Total Length	433.00 ft

Generic Inlet Inventory	
Default 100%	6

Outlet: 1.6

Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
1.6	61.09	61.09	0.00	0.00	14.00	0.00	0.00	1.28	0.00

Inlet elements for network with outlet: 1.6

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.6.1	Generic Default 1	30.00	0.00	0.00	N/A	100.0	71.03	64.91	6.12	Standar

Analysis Results
Scenario: Base

Inlet elements for network with outlet: 1.6

Label	Inlet	Total System Flow (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method
1.6.2	Generic Default 1	16.00	0.00	0.00	N/A	100.0	74.16	73.52	0.64	Standar

Junction elements for network with outlet: 1.6

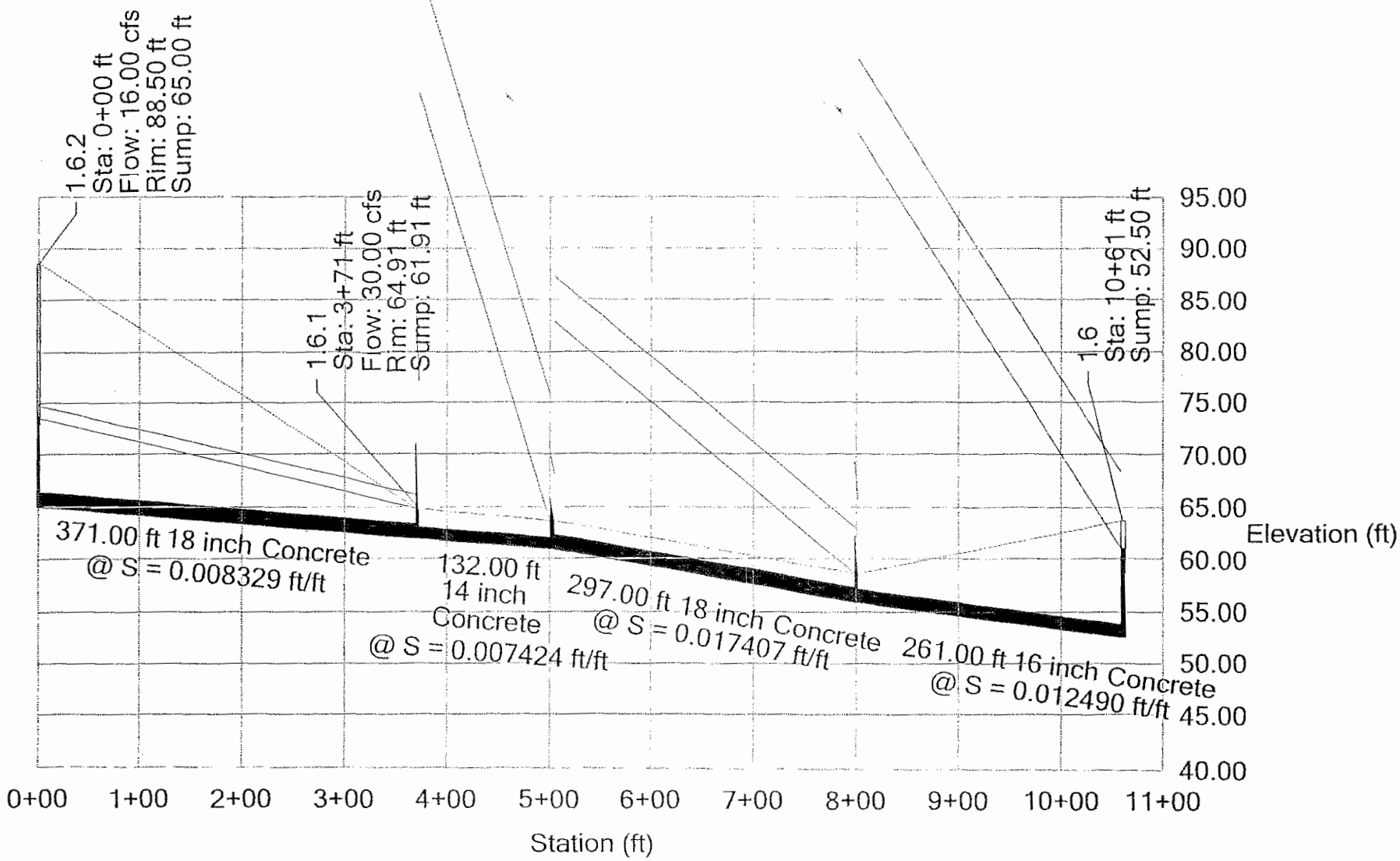
Label	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)	Headloss Method	System Additional Flow (cfs)	System Known Flow (cfs)	System Rational Flow (cfs)	System Intensity (in/hr)	System Flow Time (min)	System CA (acres)
J-1	62.18	58.59	3.59	Standar	0.00	30.00	0.00	0.00	1.05	0.00
J-2	65.92	63.68	2.24	Standar	0.00	30.00	0.00	0.00	0.76	0.00

Pipe elements for network with outlet: 1.6

Label	Section Shape	Section Size	Length (ft)	Number of Sections	Constructed Slope (ft/ft)	Energy Slope (ft/ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-6	Circular	18 inch	71.00	1	0.008329	023203	16.00	9.05	65.00	61.91	73.52	64.91
P-8	Circular	16 inch	61.00	1	0.012490	152885	30.00	21.49	55.76	52.50	100.99	61.09
P-9	Circular	14 inch	32.00	1	0.007424	311642	30.00	28.06	61.91	60.93	104.82	63.68
P-10	Circular	18 inch	97.00	1	0.017407	081574	30.00	16.98	60.93	55.76	82.82	58.59

Profile: Profile - 3

Scenario: Base



Worksheet for Nodes 2.1 & 2.2

Project Description		
Flow Element:	Box Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01500	ft/ft
Normal Depth:	8.00	ft
Height:	8.00	ft
Bottom Width:	5.00	ft

Results		
Discharge:	746.25	ft^3/s
Flow Area:	40.00	ft^2
Wetted Perimeter:	26.00	ft
Top Width:	5.00	ft
Critical Depth:	8.85	ft
Critical Slope:	0.00895	ft/ft
Velocity:	18.66	ft/s
Velocity Head:	5.41	ft
Specific Energy:	13.41	ft
Froude Number:	1.16	
Flow Type:	Supercritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	8.00	ft
Critical Depth:	8.85	ft

Worksheet for Nodes 2.1 & 2.2

Channel Slope:	0.01500	ft/ft
Critical Slope:	0.00895	ft/ft

Notes

Detailed Report for Inlet: I-2.8.1

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,440.96	ft	Calculated Station	0+65 ft
Y	229,303.90	ft		

Elevations				
Ground Elevation	68.00	ft	Hydraulic Grade Line In	65.02 ft
Rim Elevation	68.00	ft	Hydraulic Grade Line Out	64.62 ft
Sump Elevation	63.00	ft		

Headlosses				
Gravity Element Headloss	0.40	ft	Depth Out	1.62 ft
Headloss Method	Standard		Velocity Out	7.21 ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.81 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	2.89	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	35.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

Detailed Report for Inlet: I-2.8.1

External Pipe Flow					
External CA	0.00	acres	External Time of Concentration	0.00	min

Intercepted Flow Summary					
Intercepted Rational Flow	0.00	cfs	Intercepted CA	0.00	acres
Intercepted Additional Flow	0.00	cfs	Intercepted Intensity	0.00	in/hr
Intercepted Known Flow	0.00	cfs	Intercepted Tc	0.00	min
Total Intercepted Flow	0.00	cfs	Capture Efficiency	100.0	%

Upstream Piped Flow Summary					
Upstream Rational Flow	0.00	cfs	Upstream CA	0.00	acres
Upstream Additional Flow	0.00	cfs	Upstream Intensity	0.00	in/hr
Upstream Known Flow	35.00	cfs	Upstream Time Of Concentration	2.89	min
Total Upstream Flow	35.00	cfs			

Design Constraints Summary					
Pipe Matching	Inverts		Allow Drop Structure?	true	
Matchline Offset	0.00	ft	Local Pipe Matching Constraints?	false	
Design Structure Elevation?	false		Desired Sump Depth	0.00	ft

User Data
Date Installed

Detailed Report for Inlet: I-2.8.2

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,472.37	ft	Calculated Station	4+57 ft
Y	229,686.36	ft		

Elevations				
Ground Elevation	72.00	ft	Hydraulic Grade Line In	69.02 ft
Rim Elevation	72.00	ft	Hydraulic Grade Line Out	68.62 ft
Sump Elevation	67.00	ft		

Headlosses				
Gravity Element Headloss	0.40	ft	Depth Out	1.62 ft
Headloss Method	Standard		Velocity Out	7.21 ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.81 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	2.17	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	35.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

Detailed Report for Inlet: I-2.8.2

External Pipe Flow					
External CA	0.00	acres	External Time of Concentration	0.00	min

Intercepted Flow Summary					
Intercepted Rational Flow	0.00	cfs	Intercepted CA	0.00	acres
Intercepted Additional Flow	0.00	cfs	Intercepted Intensity	0.00	in/hr
Intercepted Known Flow	0.00	cfs	Intercepted Tc	0.00	min
Total Intercepted Flow	0.00	cfs	Capture Efficiency	100.0	%

Upstream Piped Flow Summary					
Upstream Rational Flow	0.00	cfs	Upstream CA	0.00	acres
Upstream Additional Flow	0.00	cfs	Upstream Intensity	0.00	in/hr
Upstream Known Flow	35.00	cfs	Upstream Time Of Concentration	2.17	min
Total Upstream Flow	35.00	cfs			

Design Constraints Summary					
Pipe Matching	Inverts		Allow Drop Structure?	true	
Matchline Offset	0.00	ft	Local Pipe Matching Constraints?	false	
Design Structure Elevation?	false		Desired Sump Depth	0.00	ft

User Data
Date Installed

Detailed Report for Inlet: I-2.8.3

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,527.80	ft	Calculated Station	5+93 ft
Y	229,810.16	ft		

Elevations				
Ground Elevation	74.50	ft	Hydraulic Grade Line In	71.42 ft
Rim Elevation	74.50	ft	Hydraulic Grade Line Out	71.42 ft
Sump Elevation	69.50	ft		

Headlosses				
Gravity Element Headloss	0.00	ft	Depth Out	1.92 ft
Headloss Method	Absolute		Velocity Out	7.31 ft/s
Absolute Headloss	0.00	ft	Velocity Head Out	0.83 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	1.98	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	35.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

Detailed Report for Inlet: I-2.8.3

External Pipe Flow					
External CA	0.00	acres	External Time of Concentration	0.00	min

Intercepted Flow Summary					
Intercepted Rational Flow	0.00	cfs	Intercepted CA	0.00	acres
Intercepted Additional Flow	0.00	cfs	Intercepted Intensity	0.00	in/hr
Intercepted Known Flow	0.00	cfs	Intercepted Tc	0.00	min
Total Intercepted Flow	0.00	cfs	Capture Efficiency	100.0	%

Upstream Piped Flow Summary					
Upstream Rational Flow	0.00	cfs	Upstream CA	0.00	acres
Upstream Additional Flow	0.00	cfs	Upstream Intensity	0.00	in/hr
Upstream Known Flow	35.00	cfs	Upstream Time Of Concentration	1.98	min
Total Upstream Flow	35.00	cfs			

Design Constraints Summary					
Pipe Matching	Inverts		Allow Drop Structure?	true	
Matchline Offset	0.00	ft	Local Pipe Matching Constraints?	false	
Design Structure Elevation?	false		Desired Sump Depth	0.00	ft

User Data
Date Installed

Detailed Report for Inlet: I-2.8.4

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,694.09	ft	Calculated Station	10+37 ft
Y	230,222.19	ft		

Elevations				
Ground Elevation	77.50	ft	Hydraulic Grade Line In	74.84 ft
Rim Elevation	77.50	ft	Hydraulic Grade Line Out	74.42 ft
Sump Elevation	72.50	ft		

Headlosses				
Gravity Element Headloss	0.42	ft	Depth Out	1.92 ft
Headloss Method	Standard		Velocity Out	7.31 ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.83 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	1.08	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	35.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

Detailed Report for Inlet: I-2.8.4

External Pipe Flow			
External CA	0.00 acres	External Time of Concentration	0.00 min

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	35.00 cfs	Upstream Time Of Concentration	1.08 min
Total Upstream Flow	35.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Inlet: I-2.8.5

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary					
X	79,675.61	ft	Calculated Station	13+46	ft
Y	230,530.75	ft			

Elevations					
Ground Elevation	80.00	ft	Hydraulic Grade Line In	77.34	ft
Rim Elevation	80.00	ft	Hydraulic Grade Line Out	76.92	ft
Sump Elevation	75.00	ft			

Headlosses					
Gravity Element Headloss	0.42	ft	Depth Out	1.92	ft
Headloss Method	Standard		Velocity Out	7.31	ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.83	ft

System Flow Summary					
Total System Flow	35.00	cfs	System Rational Flow	0.00	cfs
System Flow Time	0.49	min	System Additional Flow	0.00	cfs
System Intensity	0.00	in/hr	System Known Flow	35.00	cfs
System CA	0.00	acres	Total Diverted Flow In	0.00	cfs

Incoming Diverted Flow					
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00	cfs
Total Diverted Flow In	0.00	cfs			

Inlet Flow Summary					
Area	0.00	acres	Composite Rational C	0.00	
Inlet CA	0.00	acres	Carryover CA	0.00	acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00	in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00	min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00	cfs
Total Flow To Inlet	0.00	cfs			

Inlet Characteristics					
Inlet Type	Generic Inlet		Inlet Location	In Sag	
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section	
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false	
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00	ft

Detailed Report for Inlet: I-2.8.5

External Pipe Flow			
External CA	0.00 acres	External Time of Concentration	0.00 min

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	35.00 cfs	Upstream Time Of Concentration	0.49 min
Total Upstream Flow	35.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Inlet: I-2.8.6

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,501.93	ft	Calculated Station	16+93 ft
Y	230,813.45	ft		

Elevations				
Ground Elevation	86.00	ft	Hydraulic Grade Line In	83.34 ft
Rim Elevation	86.00	ft	Hydraulic Grade Line Out	82.92 ft
Sump Elevation	81.00	ft		

Headlosses				
Gravity Element Headloss	0.42	ft	Depth Out	1.92 ft
Headloss Method	Standard		Velocity Out	7.31 ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.83 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	0.00	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	35.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

Detailed Report for Inlet: I-2.8.6

External Pipe Flow			
External CA	0.00 acres	External Time of Concentration	0.00 min

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	0.00 cfs	Upstream Time Of Concentration	0.00 min
Total Upstream Flow	0.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Outlet: O-2.8.1

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	79,431.72	ft	Station	0+00 ft
Y	229,239.23	ft		

Elevations				
Ground Elevation	62.00	ft	Sump Elevation	55.50 ft
Rim Elevation	62.00	ft		

Tailwater Hydraulics				
Tailwater Condition	Free Outfall		Hydraulic Grade Line Out	55.50 ft

System Flow Summary				
Total System Flow	35.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	2.94	min	System Known Flow	35.00 cfs
System Intensity	0.00	in/hr	System Additional Flow	0.00 cfs
System CA	0.00	acres	Total Lost Surface Flow	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Design Constraints Summary				
Pipe Matching	Inverts		Allow Drop Structure?	true
Matchline Offset	0.00	ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false		Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Pipe: P-1

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.1		Number of Sections	1	
Downstream Node	O-2.8.1		Section Shape	Box	
Bend Angle	0.00	degrees	Section Size	3 x 2.67 ft	
Length	65.00	ft	Material	Concrete	
Constructed Slope	0.115385	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	246.25	cfs
Profile Description	S2		Energy Slope	0.053179	ft/ft
Gravity Element Headloss	8.52	ft	Velocity In	7.21	ft/s
Average Velocity	21.18	ft/s	Velocity Out	19.43	ft/s
Constructed Slope	0.115385	ft/ft	Design Capacity	246.25	cfs
Excess Full Capacity	211.25	cfs	Excess Design Capacity	211.25	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	63.00	68.00	65.67	2.33	1.62	64.62	65.43
Downstrear	55.50	62.00	58.17	3.83	0.60	56.10	61.97

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Detailed Report for Pipe: P-1

Message List	
Time (hr)	Message
	Warning: Pipe does not meet maximum slope constraint.
	Warning: Pipe does not meet maximum velocity constraint.

Detailed Report for Pipe: P-2

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.2		Number of Sections	1	
Downstream Node	I-2.8.1		Section Shape	Box	
Bend Angle	27.90	degrees	Section Size	3 x 2.67 ft	
Length	392.00	ft	Material	Concrete	
Constructed Slope	0.010204	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	73.23	cfs
Profile Description	Composite S1 S2		Energy Slope	0.009915	ft/ft
Gravity Element Headloss	3.60	ft	Velocity In	7.21	ft/s
Average Velocity	9.05	ft/s	Velocity Out	5.77	ft/s
Constructed Slope	0.010204	ft/ft	Design Capacity	73.23	cfs
Excess Full Capacity	38.23	cfs	Excess Design Capacity	38.23	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	67.00	72.00	69.67	2.33	1.62	68.62	69.43
Downstrear	63.00	68.00	65.67	2.33	2.02	65.02	65.54

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Detailed Report for Pipe: P-3

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.3		Number of Sections	1	
Downstream Node	I-2.8.2		Section Shape	Circular	
Bend Angle	23.81	degrees	Section Size	36 inch	
Length	136.00	ft	Material	Concrete	
Constructed Slope	0.018382	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	90.43	cfs
Profile Description	Composite S1 S2		Energy Slope	0.018316	ft/ft
Gravity Element Headloss	2.40	ft	Velocity In	7.31	ft/s
Average Velocity	11.98	ft/s	Velocity Out	6.91	ft/s
Constructed Slope	0.018382	ft/ft	Design Capacity	90.43	cfs
Excess Full Capacity	55.43	cfs	Excess Design Capacity	55.43	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	69.50	74.50	72.50	2.00	1.92	71.42	72.25
Downstrear	67.00	72.00	70.00	2.00	2.02	69.02	69.76

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Detailed Report for Pipe: P-4

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.4		Number of Sections	1	
Downstream Node	I-2.8.3		Section Shape	Circular	
Bend Angle	2.14	degrees	Section Size	36 inch	
Length	444.00	ft	Material	Concrete	
Constructed Slope	0.006757	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	54.82	cfs
Profile Description	S2		Energy Slope	0.006670	ft/ft
Gravity Element Headloss	3.18	ft	Velocity In	7.31	ft/s
Average Velocity	8.22	ft/s	Velocity Out	8.22	ft/s
Constructed Slope	0.006757	ft/ft	Design Capacity	54.82	cfs
Excess Full Capacity	19.82	cfs	Excess Design Capacity	19.82	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	72.50	77.50	75.50	2.00	1.92	74.42	75.25
Downstrear	69.50	74.50	72.50	2.00	1.74	71.24	72.29

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Detailed Report for Pipe: P-5

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.5		Number of Sections	1	
Downstream Node	I-2.8.4		Section Shape	Circular	
Bend Angle	25.41	degrees	Section Size	36 inch	
Length	309.00	ft	Material	Concrete	
Constructed Slope	0.008091	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	59.99	cfs
Profile Description	Composite S1 S2		Energy Slope	0.007673	ft/ft
Gravity Element Headloss	2.08	ft	Velocity In	7.31	ft/s
Average Velocity	8.81	ft/s	Velocity Out	5.92	ft/s
Constructed Slope	0.008091	ft/ft	Design Capacity	59.99	cfs
Excess Full Capacity	24.99	cfs	Excess Design Capacity	24.99	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	75.00	80.00	78.00	2.00	1.92	76.92	77.75
Downstrear	72.50	77.50	75.50	2.00	2.34	74.84	75.38

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Detailed Report for Pipe: P-6

Note:
The input data may have been modified since the last calculation was performed.
The calculated results may be outdated.

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2.8.6		Number of Sections	1	
Downstream Node	I-2.8.5		Section Shape	Circular	
Bend Angle	18.06	degrees	Section Size	36 inch	
Length	347.00	ft	Material	Concrete	
Constructed Slope	0.017291	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	35.00	cfs	Full Capacity	87.70	cfs
Profile Description	Composite S1 S2		Energy Slope	0.016919	ft/ft
Gravity Element Headloss	5.58	ft	Velocity In	7.31	ft/s
Average Velocity	11.71	ft/s	Velocity Out	5.92	ft/s
Constructed Slope	0.017291	ft/ft	Design Capacity	87.70	cfs
Excess Full Capacity	52.70	cfs	Excess Design Capacity	52.70	cfs

Elevations/Depths

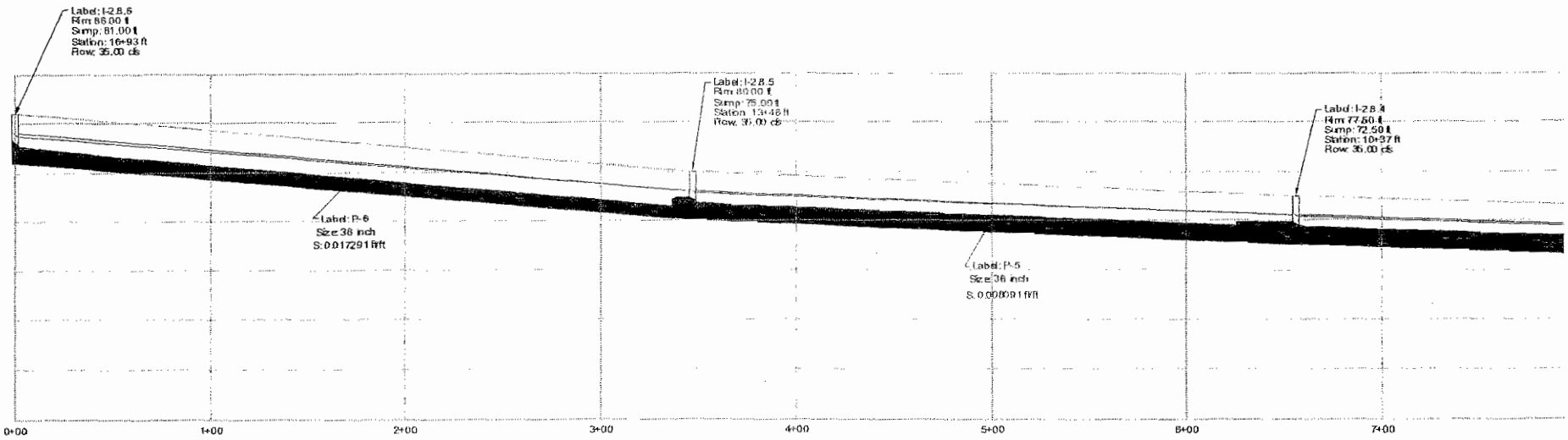
	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	81.00	86.00	84.00	2.00	1.92	82.92	83.75
Downstrear	75.00	80.00	78.00	2.00	2.34	77.34	77.88

Pipe Design Options					
Design Pipe?	false		Design Upstream Invert?	false	
Design Downstream Invert?	false		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	2.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

rofile
Scenario: Base



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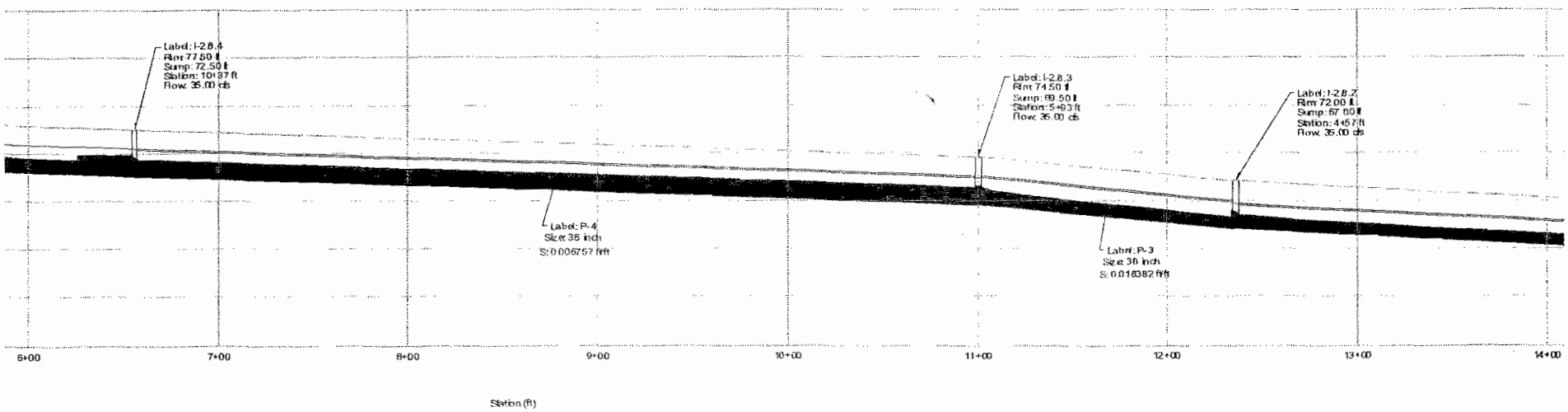
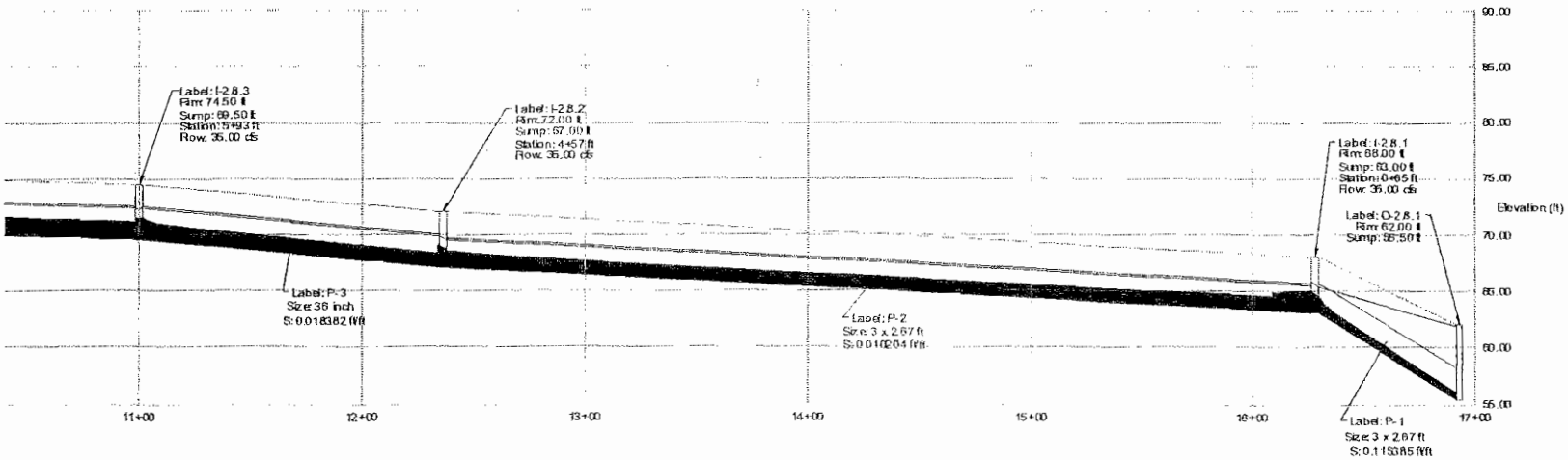
rofile
Scenario: Base

Profile: Profile - 1
Scenario: Base



rofile
Scenario: Base



Worksheet for Node 3.0

Project Description		
Flow Element:	Elliptical Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.024	
Channel Slope:	0.01500	ft/ft
Normal Depth:	3.67	ft
Rise:	3.67	ft
Span:	6.00	ft

Results		
Discharge:	141.72	ft^3/s
Flow Area:	17.29	ft^2
Wetted Perimeter:	15.40	ft
Top Width:	0.00	ft
Critical Depth:	2.88	ft
Percent Full:	100.0	%
Critical Slope:	0.01521	ft/ft
Velocity:	8.19	ft/s
Velocity Head:	1.04	ft
Specific Energy:	4.71	ft
Froude Number:	0.00	
Max Discharge:	154.74	ft^3/s
Discharge Full:	141.62	ft^3/s
Slope Full:	0.01498	ft/ft
Flow Type:	Subcritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%

Worksheet for Node 3.0

Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	3.67	ft
Critical Depth:	2.88	ft
Channel Slope:	0.01500	ft/ft
Critical Slope:	0.01521	ft/ft

Detailed Report for Inlet: I-3.2.1

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	81,886.83	ft	Calculated Station	6+41 ft
Y	227,727.98	ft		

Elevations				
Ground Elevation	67.00	ft	Hydraulic Grade Line In	65.23 ft
Rim Elevation	67.00	ft	Hydraulic Grade Line Out	64.68 ft
Sump Elevation	62.00	ft		

Headlosses				
Gravity Element Headloss	0.55	ft	Depth Out	2.68 ft
Headloss Method	Standard		Velocity Out	8.40 ft/s
Headloss Coefficient	0.50		Velocity Head Out	1.10 ft

System Flow Summary				
Total System Flow	56.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	1.19	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	56.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

External Pipe Flow				
External CA	0.00	acres	External Time of Concentration	0.00 min

Detailed Report for Inlet: I-3.2.1

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	46.00 cfs	Upstream Time Of Concentration	1.19 min
Total Upstream Flow	46.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Detailed Report for Inlet: I-3.2.2

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	82,231.33	ft	Calculated Station	10+74 ft
Y	227,465.50	ft		

Elevations				
Ground Elevation	68.00	ft	Hydraulic Grade Line In	67.62 ft
Rim Elevation	68.00	ft	Hydraulic Grade Line Out	67.29 ft
Sump Elevation	63.00	ft		

Headlosses				
Gravity Element Headloss	0.33	ft	Depth Out	4.29 ft
Headloss Method	Standard		Velocity Out	6.51 ft/s
Headloss Coefficient	0.50		Velocity Head Out	0.66 ft

System Flow Summary				
Total System Flow	46.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	0.08	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	46.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

External Pipe Flow				
External CA	0.00	acres	External Time of Concentration	0.00 min

Detailed Report for Inlet: I-3.2.2

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	34.00 cfs	Upstream Time Of Concentration	0.08 min
Total Upstream Flow	34.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data	
Date Installed	

Detailed Report for Inlet: I-32.3

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary				
X	82,315.40	ft	Calculated Station	11+66 ft
Y	227,502.41	ft		

Elevations				
Ground Elevation	69.00	ft	Hydraulic Grade Line In	71.88 ft
Rim Elevation	69.00	ft	Hydraulic Grade Line Out	69.00 ft
Sump Elevation	64.00	ft		

Headlosses				
Gravity Element Headloss	2.88	ft	Depth Out	5.00 ft
Headloss Method	Standard		Velocity Out	19.24 ft/s
Headloss Coefficient	0.50		Velocity Head Out	5.75 ft

System Flow Summary				
Total System Flow	34.00	cfs	System Rational Flow	0.00 cfs
System Flow Time	0.00	min	System Additional Flow	0.00 cfs
System Intensity	0.00	in/hr	System Known Flow	34.00 cfs
System CA	0.00	acres	Total Diverted Flow In	0.00 cfs

Incoming Diverted Flow				
Local Diverted Flow In	0.00	cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00	cfs		

Inlet Flow Summary				
Area	0.00	acres	Composite Rational C	0.00
Inlet CA	0.00	acres	Carryover CA	0.00 acres
Total Inlet CA	0.00	acres	Total Inlet Intensity	0.00 in/hr
Total Inlet Rational Flow	0.00	cfs	Total Inlet Time of Concentration	0.00 min
Total Inlet Additional Flow	0.00	cfs	Total Inlet Known Flow	0.00 cfs
Total Flow To Inlet	0.00	cfs		

Inlet Characteristics				
Inlet Type	Generic Inlet		Inlet Location	In Sag
Inlet	Generic Default 100%		Inlet Section Properties	Gutter Section
Road Cross Slope	0.020	ft/ft	Depressed Gutter?	false
Gutter Cross Slope	0.020	ft/ft	Gutter Width	0.00 ft

External Pipe Flow				
External CA	0.00	acres	External Time of Concentration	0.00 min

Detailed Report for Inlet: I-32.3

Intercepted Flow Summary			
Intercepted Rational Flow	0.00 cfs	Intercepted CA	0.00 acres
Intercepted Additional Flow	0.00 cfs	Intercepted Intensity	0.00 in/hr
Intercepted Known Flow	0.00 cfs	Intercepted Tc	0.00 min
Total Intercepted Flow	0.00 cfs	Capture Efficiency	100.0 %

Upstream Piped Flow Summary			
Upstream Rational Flow	0.00 cfs	Upstream CA	0.00 acres
Upstream Additional Flow	0.00 cfs	Upstream Intensity	0.00 in/hr
Upstream Known Flow	0.00 cfs	Upstream Time Of Concentration	0.00 min
Total Upstream Flow	0.00 cfs		

Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

User Data
Date Installed

Message List

Time (hr)	Message
	Warning: Structure is flooded.

Detailed Report for Outlet: O-3.2

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Geometric Summary			
X	81,378.29 ft	Station	0+00 ft
Y	228,117.58 ft		

Elevations			
Ground Elevation	61.00 ft	Sump Elevation	58.00 ft
Rim Elevation	61.00 ft		

Tailwater Hydraulics			
Tailwater Condition	Free Outfall	Hydraulic Grade Line Out	58.00 ft

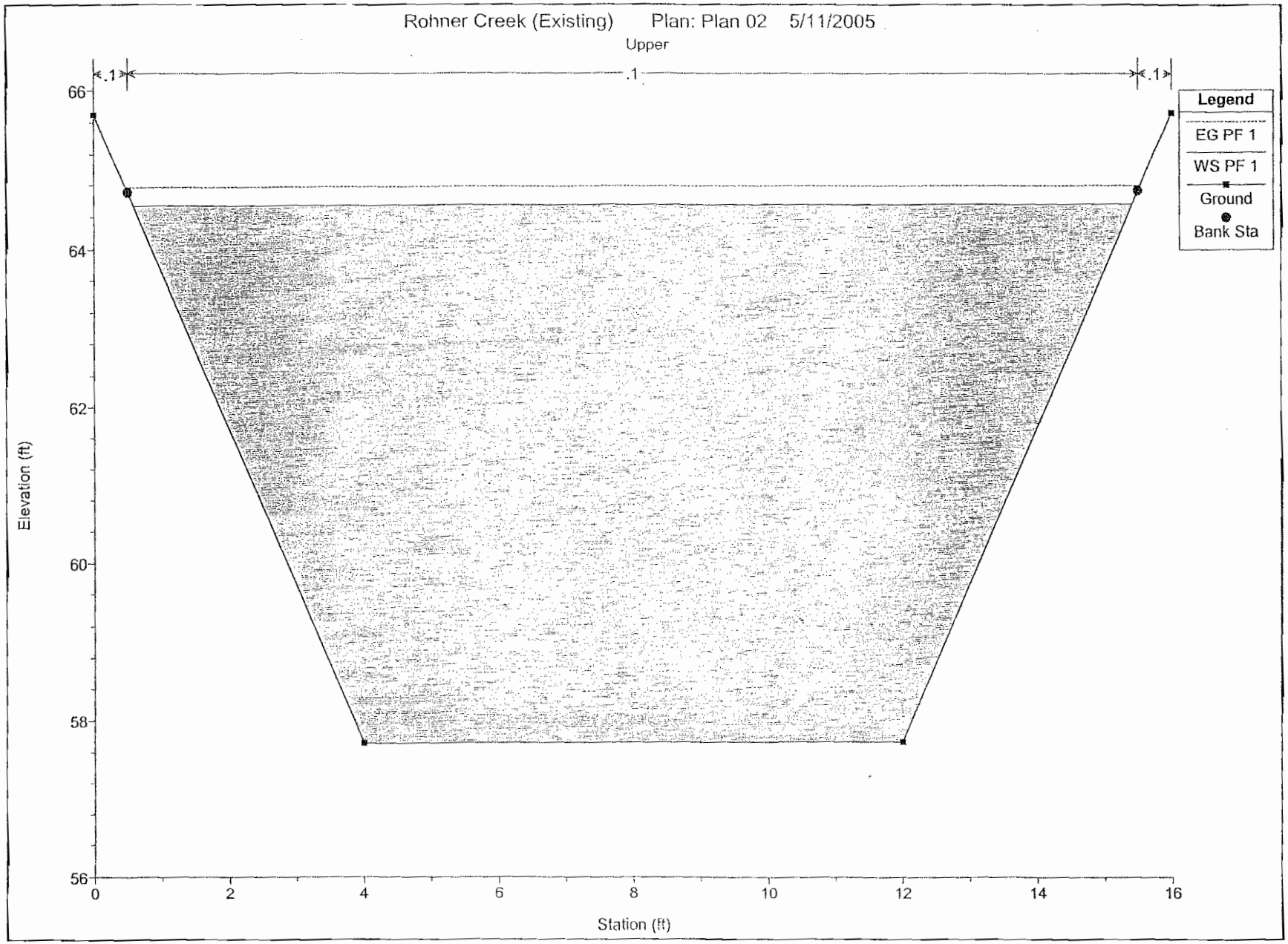
System Flow Summary			
Total System Flow	56.00 cfs	System Rational Flow	0.00 cfs
System Flow Time	2.46 min	System Known Flow	56.00 cfs
System Intensity	0.00 in/hr	System Additional Flow	0.00 cfs
System CA	0.00 acres	Total Lost Surface Flow	0.00 cfs
Total Diverted Flow In	0.00 cfs		

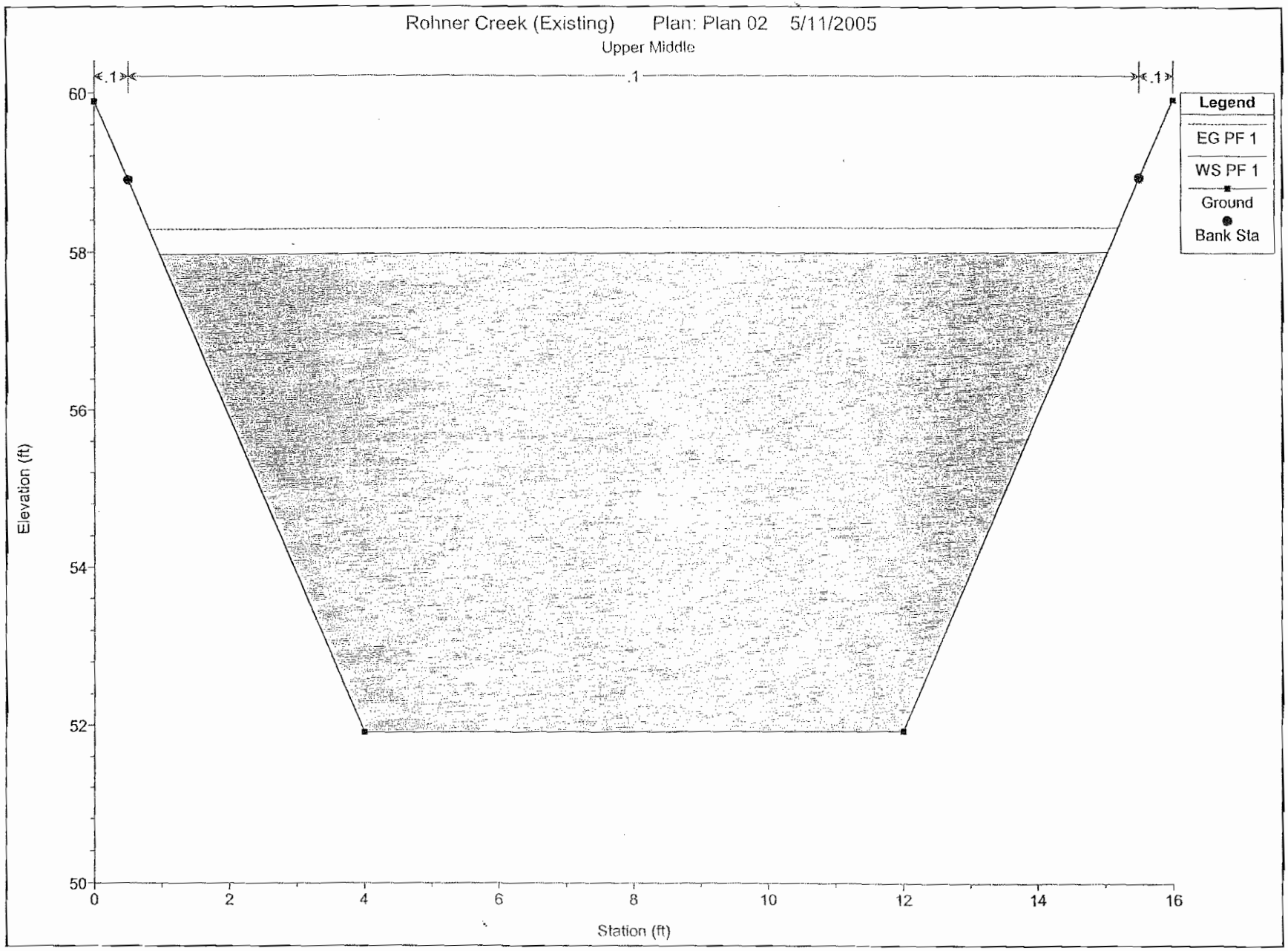
Incoming Diverted Flow			
Local Diverted Flow In	0.00 cfs	Global Diverted Flow In	0.00 cfs
Total Diverted Flow In	0.00 cfs		

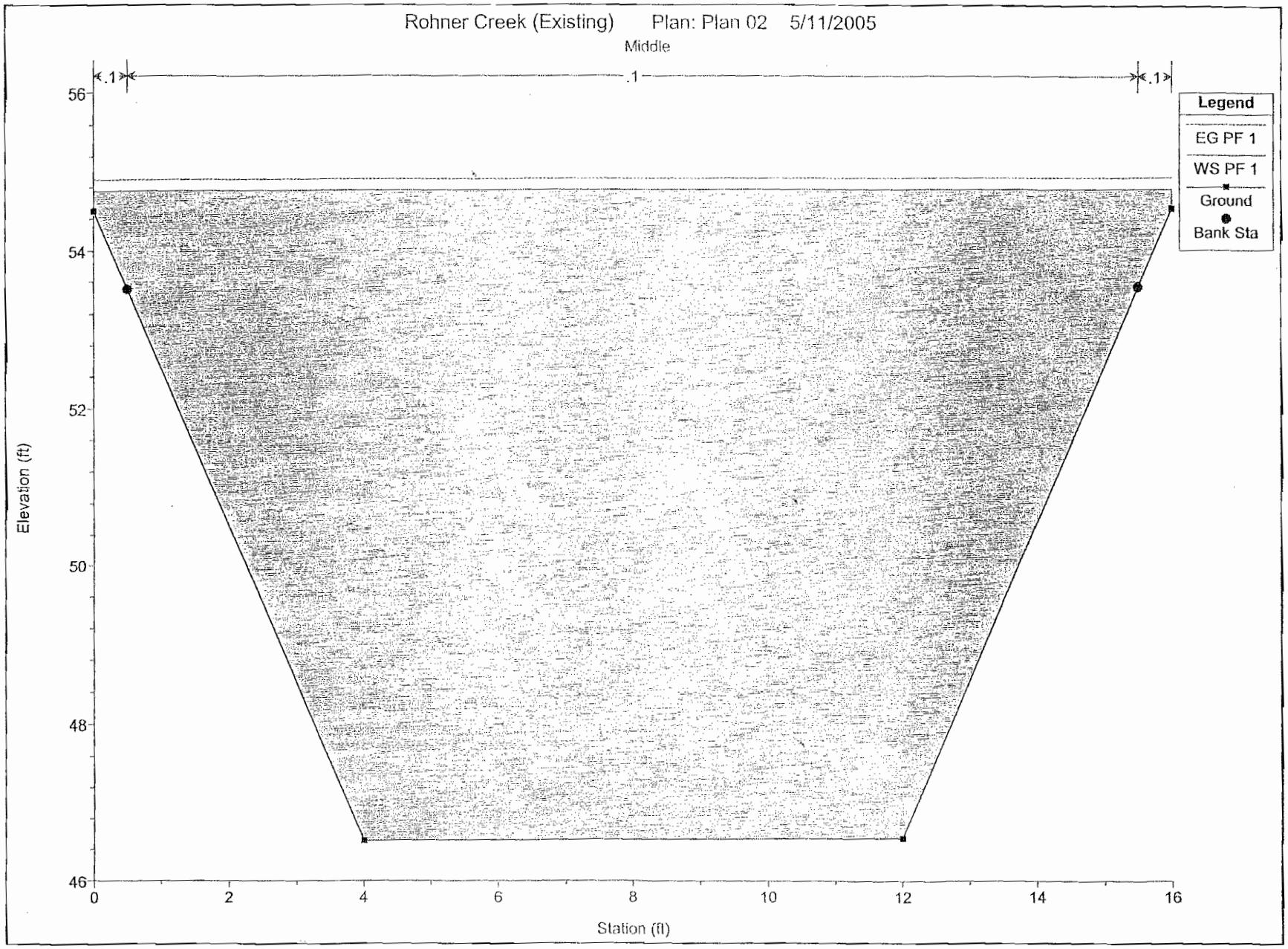
Design Constraints Summary			
Pipe Matching	Inverts	Allow Drop Structure?	true
Matchline Offset	0.00 ft	Local Pipe Matching Constraints?	false
Design Structure Elevation?	false	Desired Sump Depth	0.00 ft

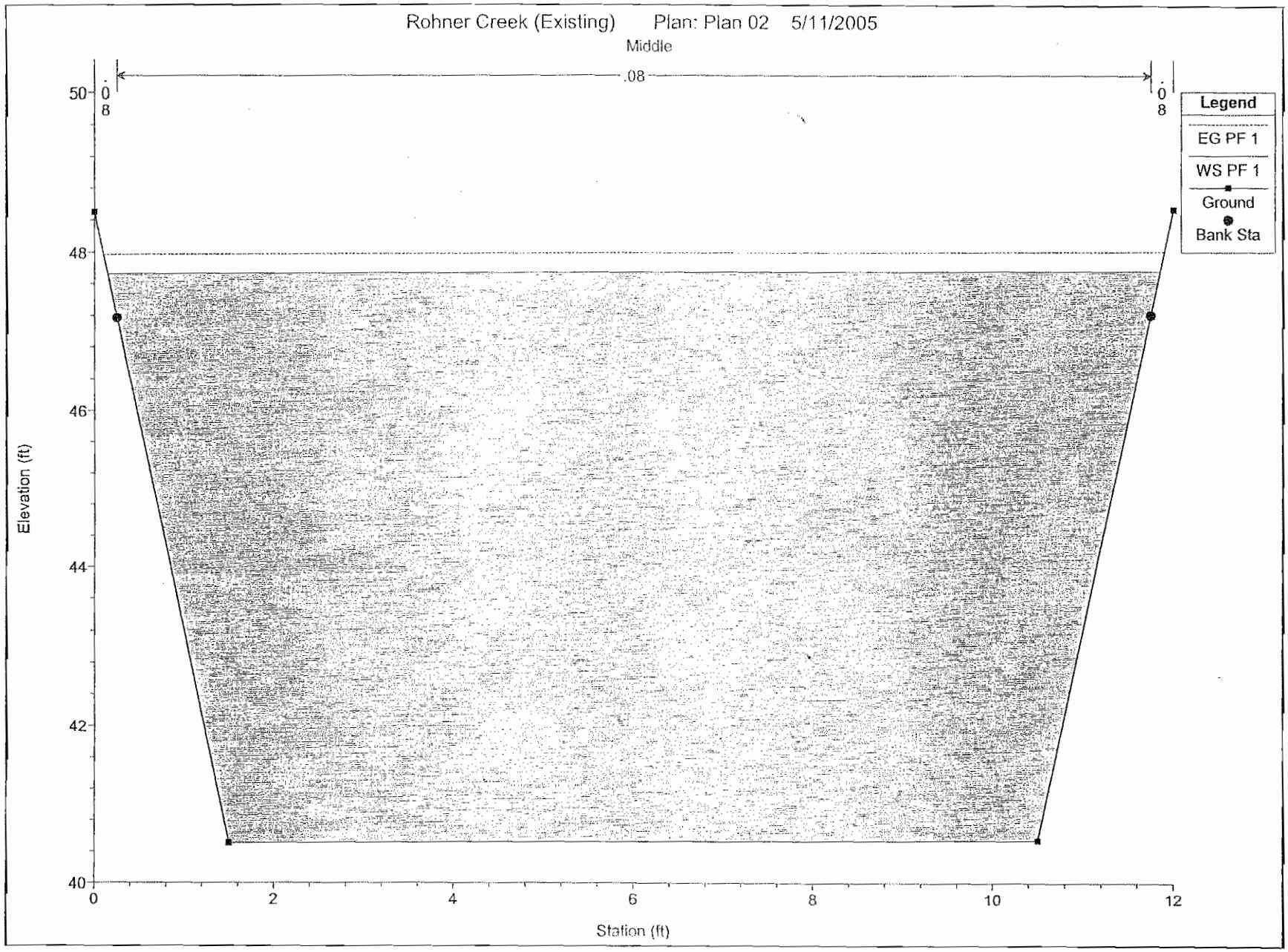
User Data
Date Installed

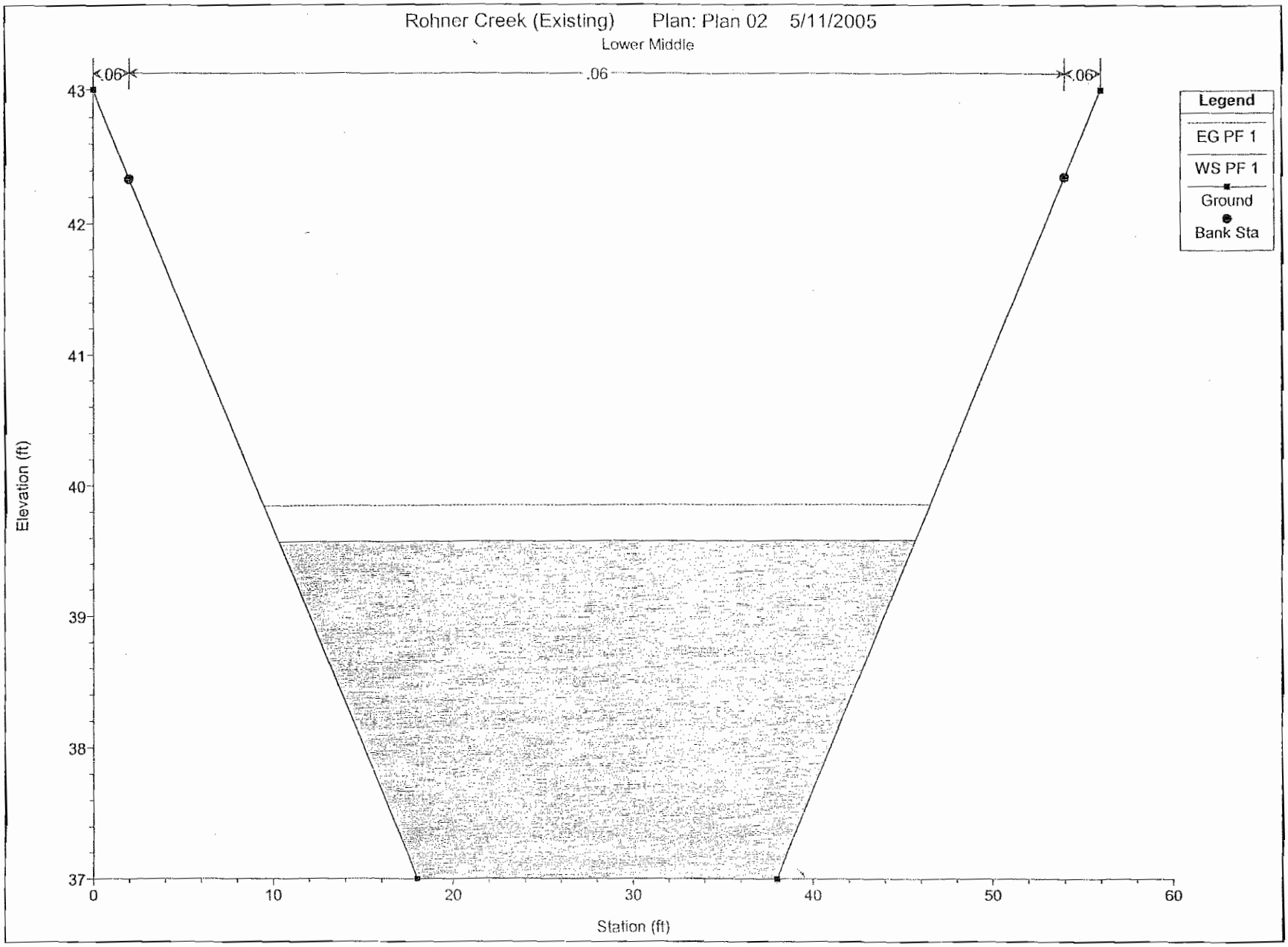
Appendix C
HEC-RAS Hydraulic Model Results

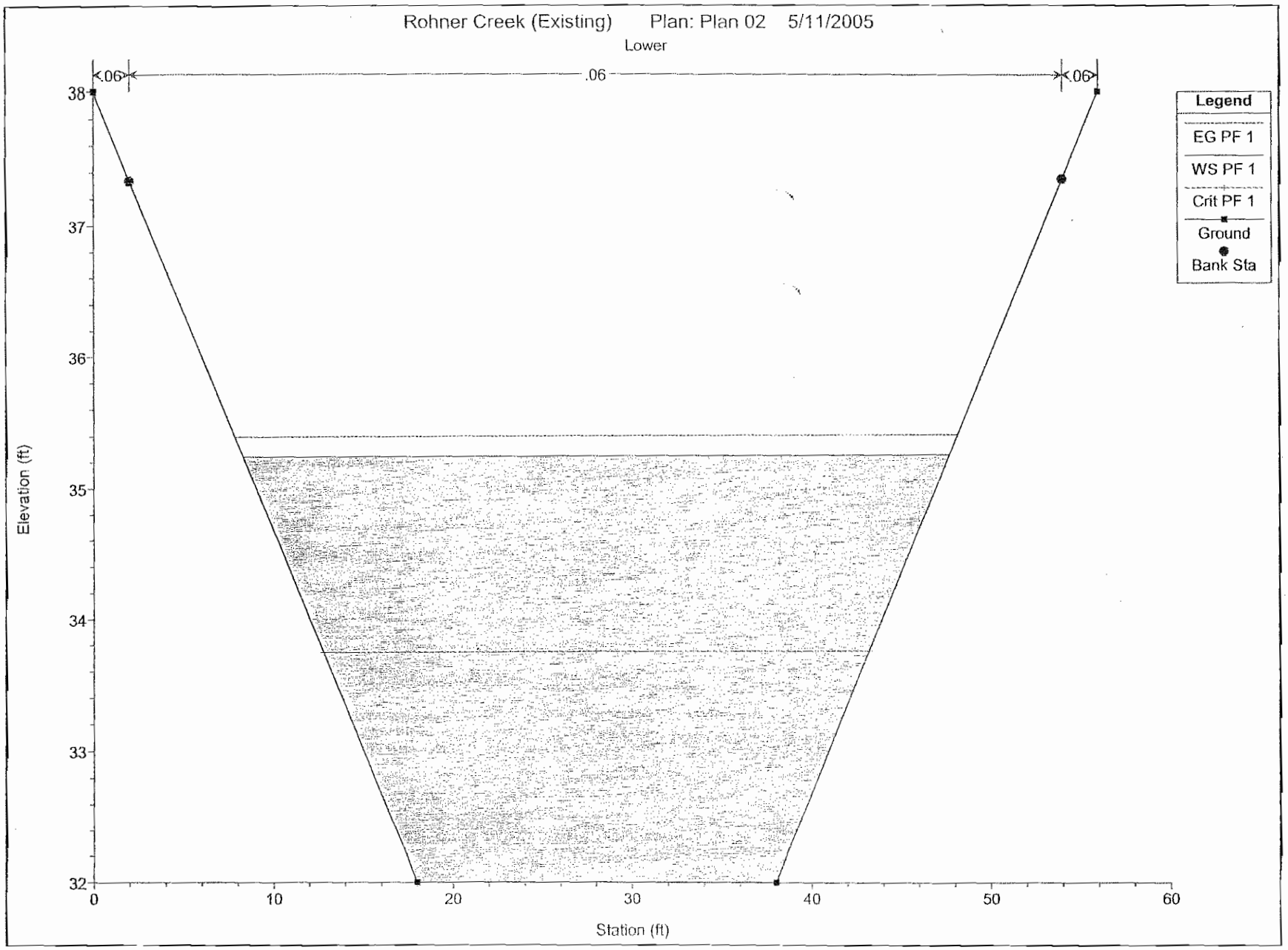

Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Upper
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
66
64
62
60
58
56
0
2
4
6
8
10
12
14
16
Station (ft)


Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Upper Middle
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
0
2
4
6
8
10
12
14
16
Station (ft)


Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Middle
.1
.1
.1
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
56
54
52
50
48
46
0
2
4
6
8
10
12
14
16
Station (ft)


Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Middle
.08
.08
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
50
48
46
44
42
40
0
2
4
6
8
10
12
Station (ft)


Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Lower Middle
.06
.06
.06
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
43
42
41
40
39
38
37
0
10
20
30
40
50
60
Station (ft)


Rohner Creek (Existing) Plan: Plan 02 5/11/2005
Lower
.06
.06
.06
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
38
37
36
35
34
33
32
0
10
20
30
40
50
60
Station (ft)

Strangs Creek

Plan: 930 ft

E.G. Elev (ft)	48.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.050	
W.S. Elev (ft)	48.06	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)		Flow Area (sq ft)		374.06	
E.G. Slope (ft/ft)	0.002817	Area (sq ft)		374.06	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	52.61	Top Width (ft)		52.61	
Vel Total (ft/s)	5.35	Avg. Vel. (ft/s)		5.35	
Max Chl Dpth (ft)	10.86	Hydr. Depth (ft)		7.11	
Conv. Total (cfs)	37684.2	Conv. (cfs)		37684.2	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		59.93	
Min Ch El (ft)	37.20	Shear (lb/sq ft)		1.10	
Alpha	1.00	Stream Power (lb/ft s)		5.87	
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)		7.23	
C & E Loss (ft)	0.07	Cum SA (acres)		1.11	

Plan: 850 ft

E.G. Elev (ft)	48.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.050	
W.S. Elev (ft)	48.07	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)		535.69	
E.G. Slope (ft/ft)	0.001294	Area (sq ft)		535.69	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	75.16	Top Width (ft)		75.16	
Vel Total (ft/s)	3.73	Avg. Vel. (ft/s)		3.73	
Max Chl Dpth (ft)	12.57	Hydr. Depth (ft)		7.13	
Conv. Total (cfs)	55601.4	Conv. (cfs)		55601.4	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		82.07	
Min Ch El (ft)	35.50	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		1.97	
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)		6.39	
C & E Loss (ft)	0.03	Cum SA (acres)		1.00	

Plan: 650 ft

E.G. Elev (ft)	47.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.		0.050	
W.S. Elev (ft)	47.28	Reach Len. (ft)	220.00	220.00	220.00
Crit W.S. (ft)		Flow Area (sq ft)		331.34	
E.G. Slope (ft/ft)	0.003735	Area (sq ft)		331.34	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	41.54	Top Width (ft)		41.54	
Vel Total (ft/s)	6.04	Avg. Vel. (ft/s)		6.04	
Max Chl Dpth (ft)	12.28	Hydr. Depth (ft)		7.98	
Conv. Total (cfs)	32724.3	Conv. (cfs)		32724.3	
Length Wtd. (ft)	220.00	Wetted Per. (ft)		54.69	
Min Ch El (ft)	35.00	Shear (lb/sq ft)		1.41	
Alpha	1.00	Stream Power (lb/ft s)		8.53	
Frctn Loss (ft)	1.25	Cum Volume (acre-ft)		4.40	
C & E Loss (ft)	0.04	Cum SA (acres)		0.73	

Plan: 430 ft

E.G. Elev (ft)	46.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.97	Wt. n-Val.		0.050	
W.S. Elev (ft)	45.58	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)		Flow Area (sq ft)		252.40	
E.G. Slope (ft/ft)	0.009690	Area (sq ft)		252.40	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	49.02	Top Width (ft)		49.02	
Vel Total (ft/s)	7.92	Avg. Vel. (ft/s)		7.92	
Max Chl Dpth (ft)	11.38	Hydr. Depth (ft)		5.15	
Conv. Total (cfs)	20317.4	Conv. (cfs)		20317.4	
Length Wtd. (ft)	150.00	Wetted Per. (ft)		56.62	
Min Ch El (ft)	34.20	Shear (lb/sq ft)		2.70	
Alpha	1.00	Stream Power (lb/ft s)		21.37	
Frctn Loss (ft)	0.75	Cum Volume (acre-ft)		2.93	
C & E Loss (ft)	0.16	Cum SA (acres)		0.50	

Plan: 280 ft

E.G. Elev (ft)	45.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.050	
W.S. Elev (ft)	45.20	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)		376.29	
E.G. Slope (ft/ft)	0.003051	Area (sq ft)		376.29	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	58.70	Top Width (ft)		58.70	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	10.70	Hydr. Depth (ft)		6.41	
Conv. Total (cfs)	36209.2	Conv. (cfs)		36209.2	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		64.58	
Min Ch El (ft)	34.50	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)		5.90	
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)		1.84	
C & E Loss (ft)	0.05	Cum SA (acres)		0.31	

Plan: 80 ft

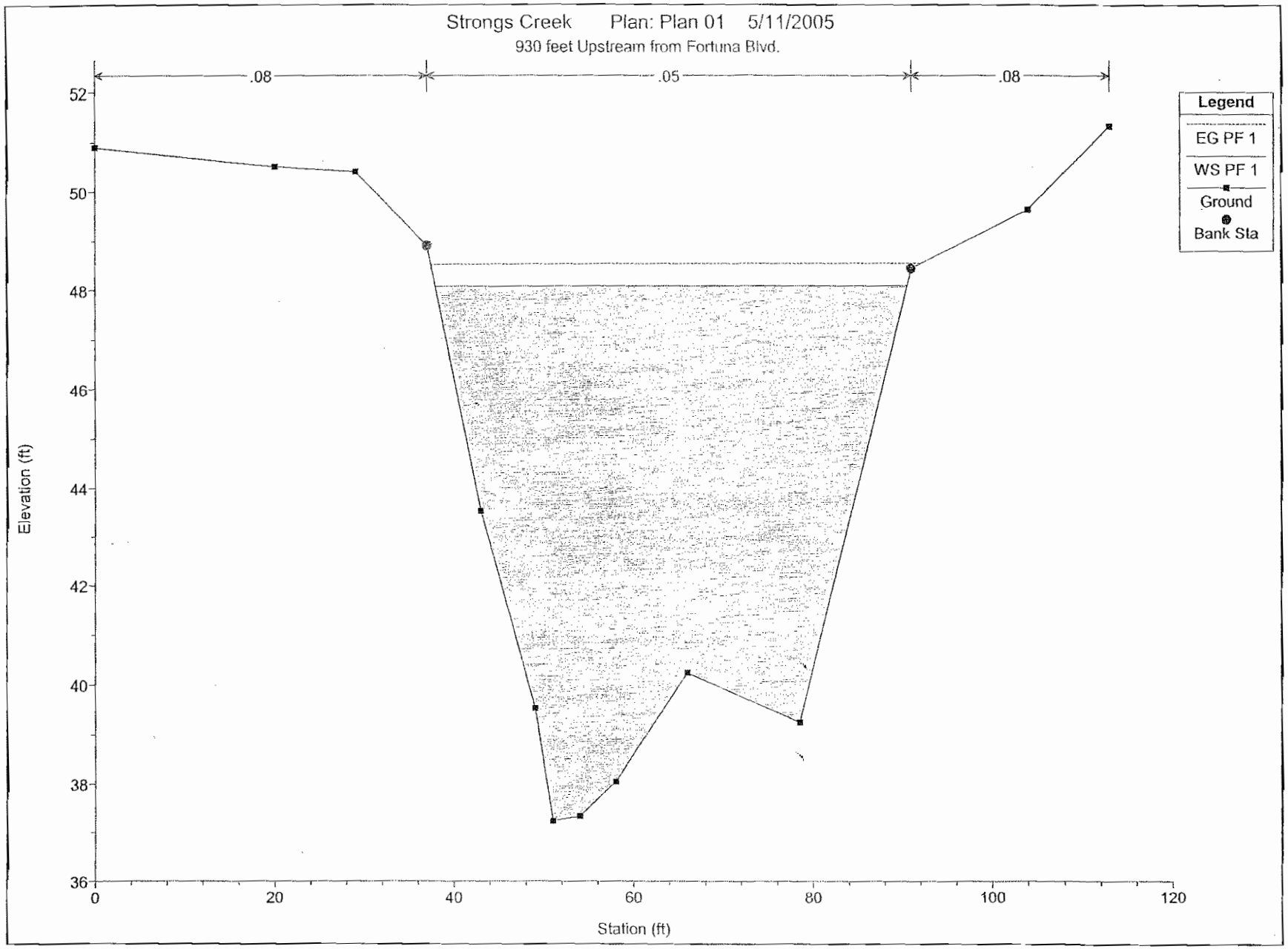
E.G. Elev (ft)	44.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.		0.050	
W.S. Elev (ft)	43.66	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	41.57	Flow Area (sq ft)		251.86	
E.G. Slope (ft/ft)	0.008375	Area (sq ft)		251.86	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	44.27	Top Width (ft)		44.27	
Vel Total (ft/s)	7.94	Avg. Vel. (ft/s)		7.94	
Max Chl Dpth (ft)	9.26	Hydr. Depth (ft)		5.69	
Conv. Total (cfs)	21853.8	Conv. (cfs)		21853.8	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		50.49	
Min Ch El (ft)	34.40	Shear (lb/sq ft)		2.61	
Alpha	1.00	Stream Power (lb/ft s)		20.71	
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)		0.40	
C & E Loss (ft)	0.13	Cum SA (acres)		0.08	

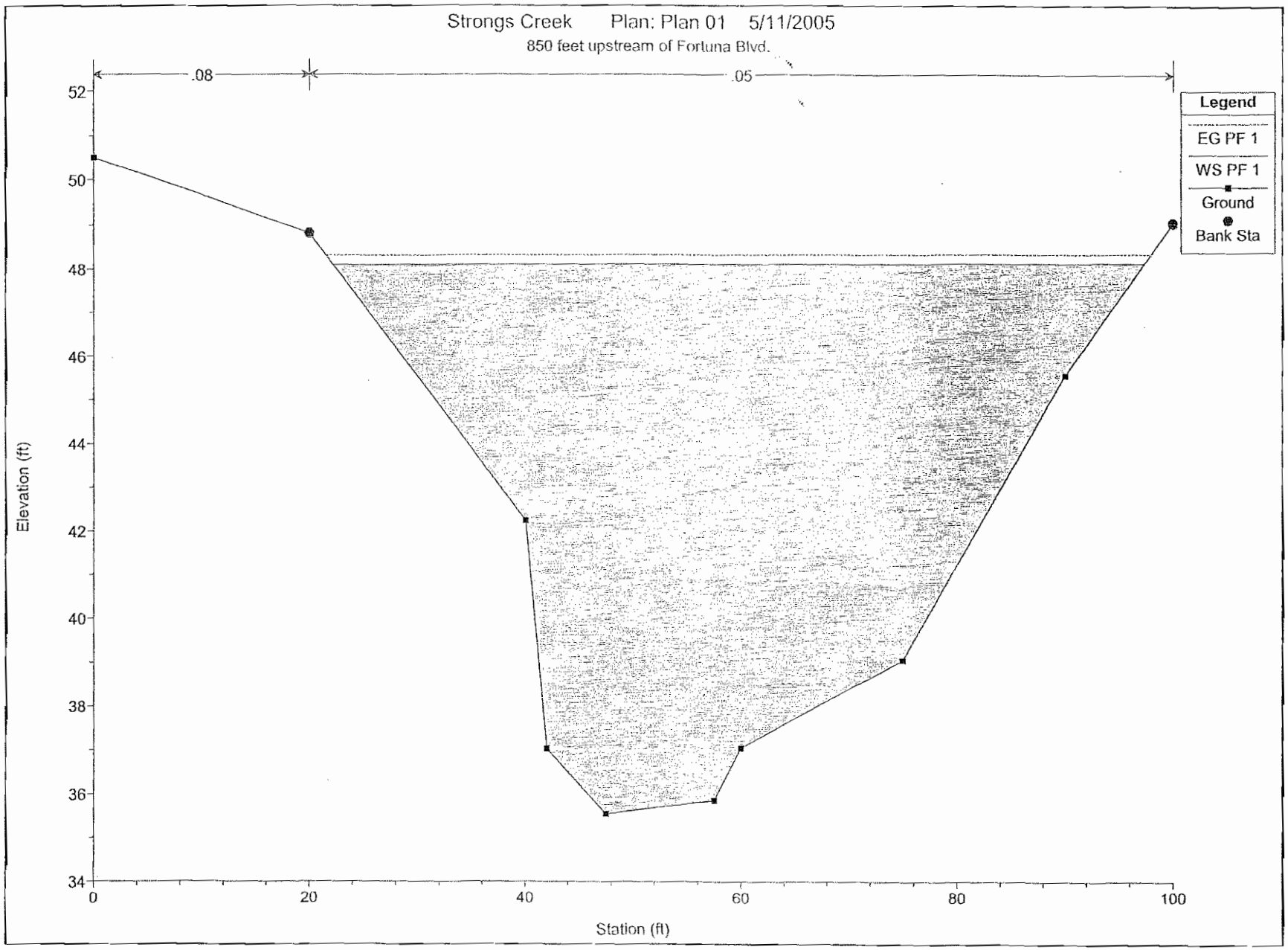
Plan: 5 ft

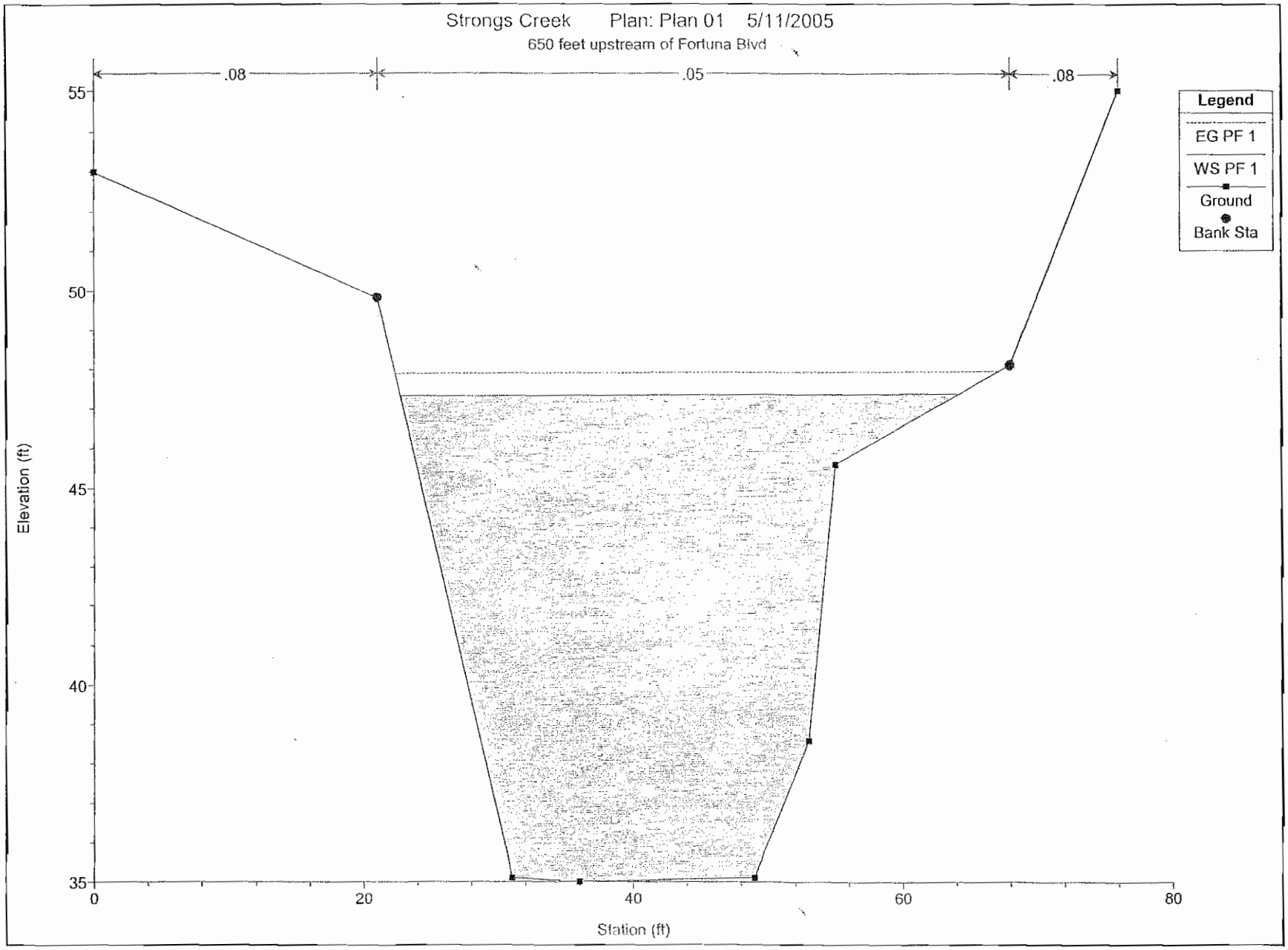
E.G. Elev (ft)	43.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.25	Wt. n-Val.		0.050	
W.S. Elev (ft)	41.17	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)	41.17	Flow Area (sq ft)		166.32	
E.G. Slope (ft/ft)	0.026220	Area (sq ft)		166.32	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	37.09	Top Width (ft)		37.09	
Vel Total (ft/s)	12.02	Avg. Vel. (ft/s)		12.02	
Max Chl Dpth (ft)	7.17	Hydr. Depth (ft)		4.48	
Conv. Total (cfs)	12351.3	Conv. (cfs)		12351.3	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		42.11	
Min Ch El (ft)	34.00	Shear (lb/sq ft)		6.47	
Alpha	1.00	Stream Power (lb/ft s)		77.75	
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)		0.02	
C & E Loss (ft)	0.07	Cum SA (acres)		0.00	

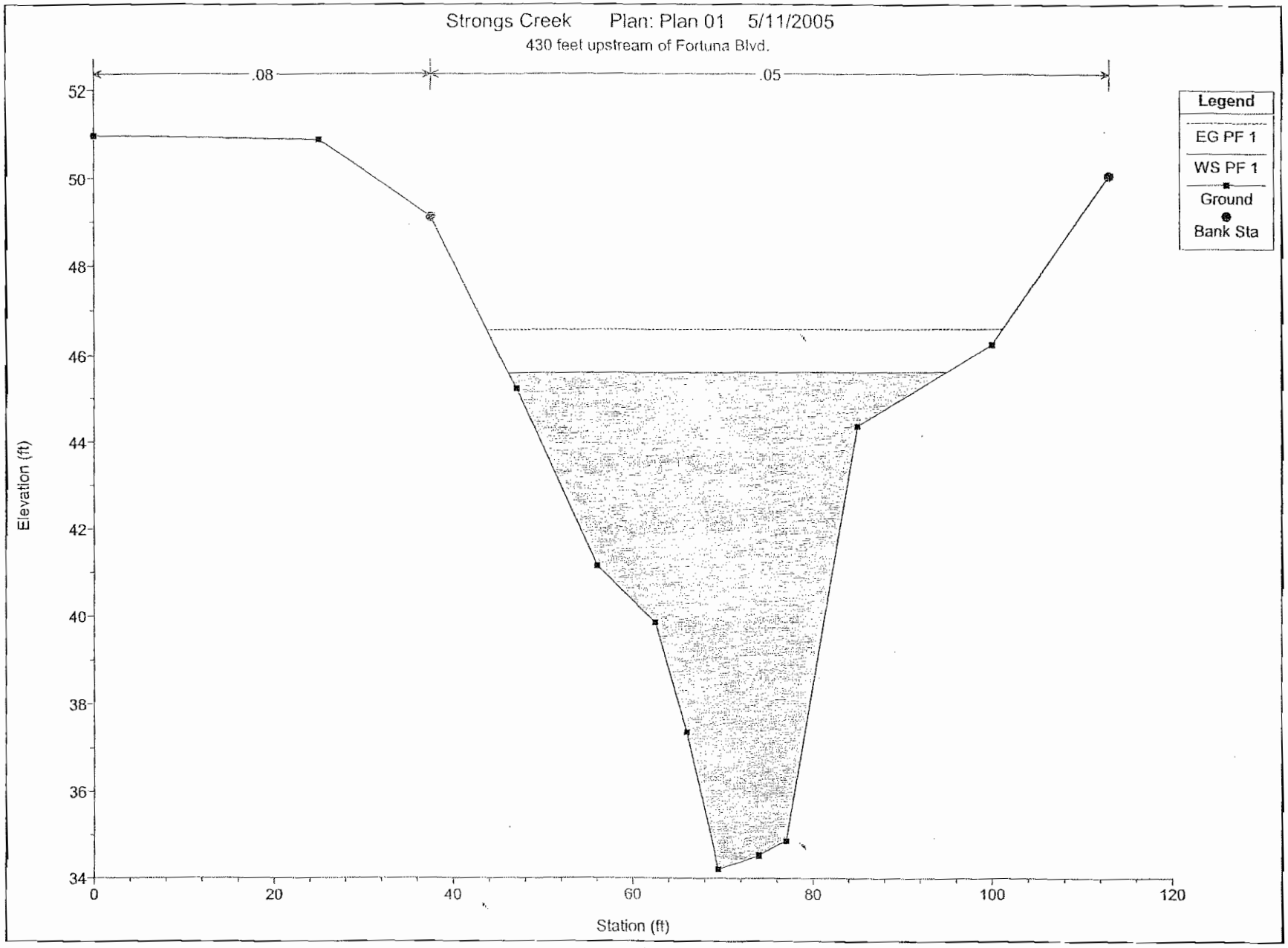
Plan: 0 ft

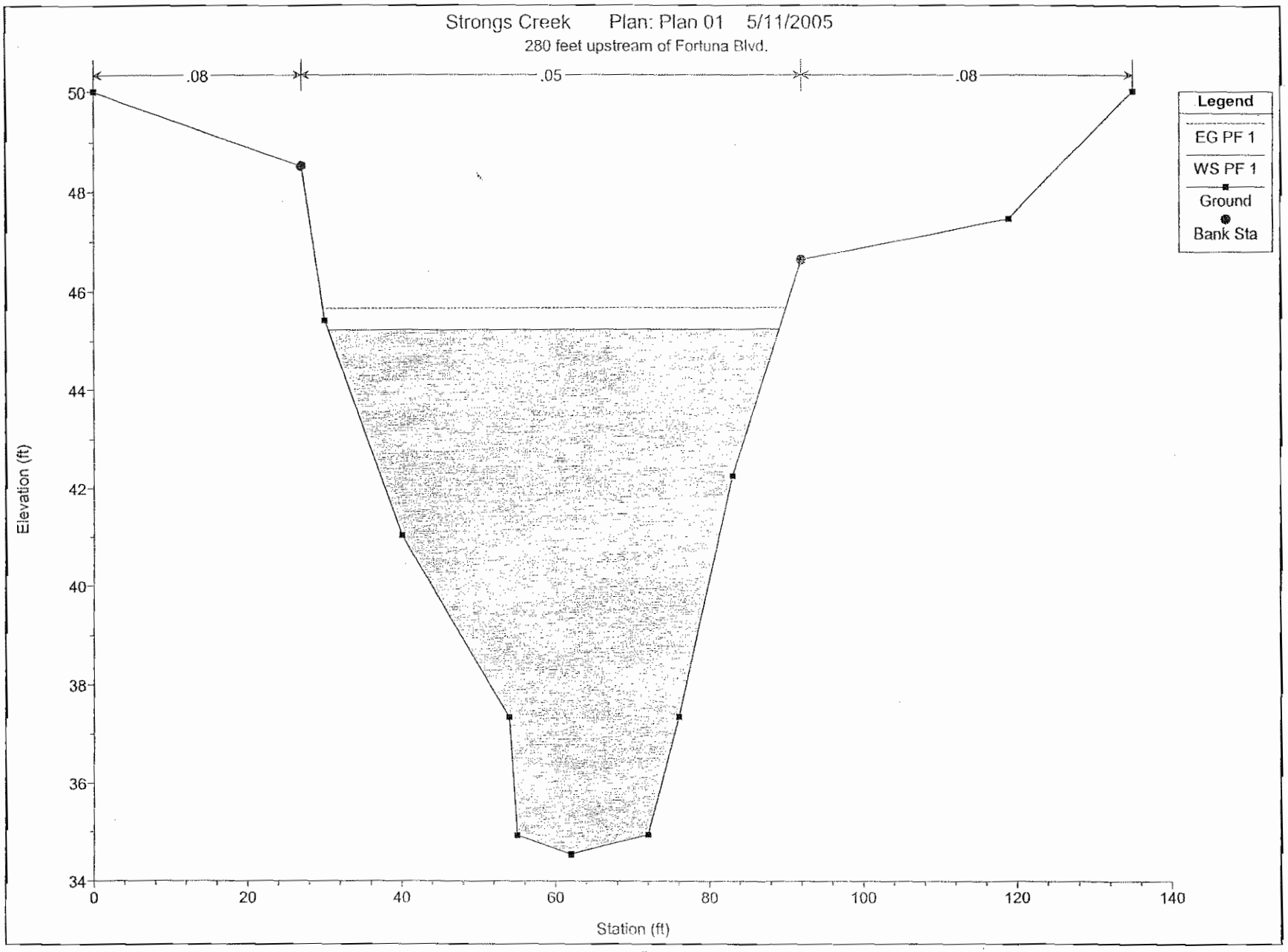
E.G. Elev (ft)	42.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.96	Wt. n-Val.		0.013	
W.S. Elev (ft)	39.78	Reach Len. (ft)			
Crit W.S. (ft)	39.78	Flow Area (sq ft)		144.82	
E.G. Slope (ft/ft)	0.002279	Area (sq ft)		144.82	
Q Total (cfs)	2000.00	Flow (cfs)		2000.00	
Top Width (ft)	24.45	Top Width (ft)		24.45	
Vel Total (ft/s)	13.81	Avg. Vel. (ft/s)		13.81	
Max Chl Dpth (ft)	5.98	Hydr. Depth (ft)		5.92	
Conv. Total (cfs)	41895.4	Conv. (cfs)		41895.4	
Length Wtd. (ft)		Wetted Per. (ft)		35.96	
Min Ch El (ft)	33.80	Shear (lb/sq ft)		0.57	
Alpha	1.00	Stream Power (lb/ft s)		7.91	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

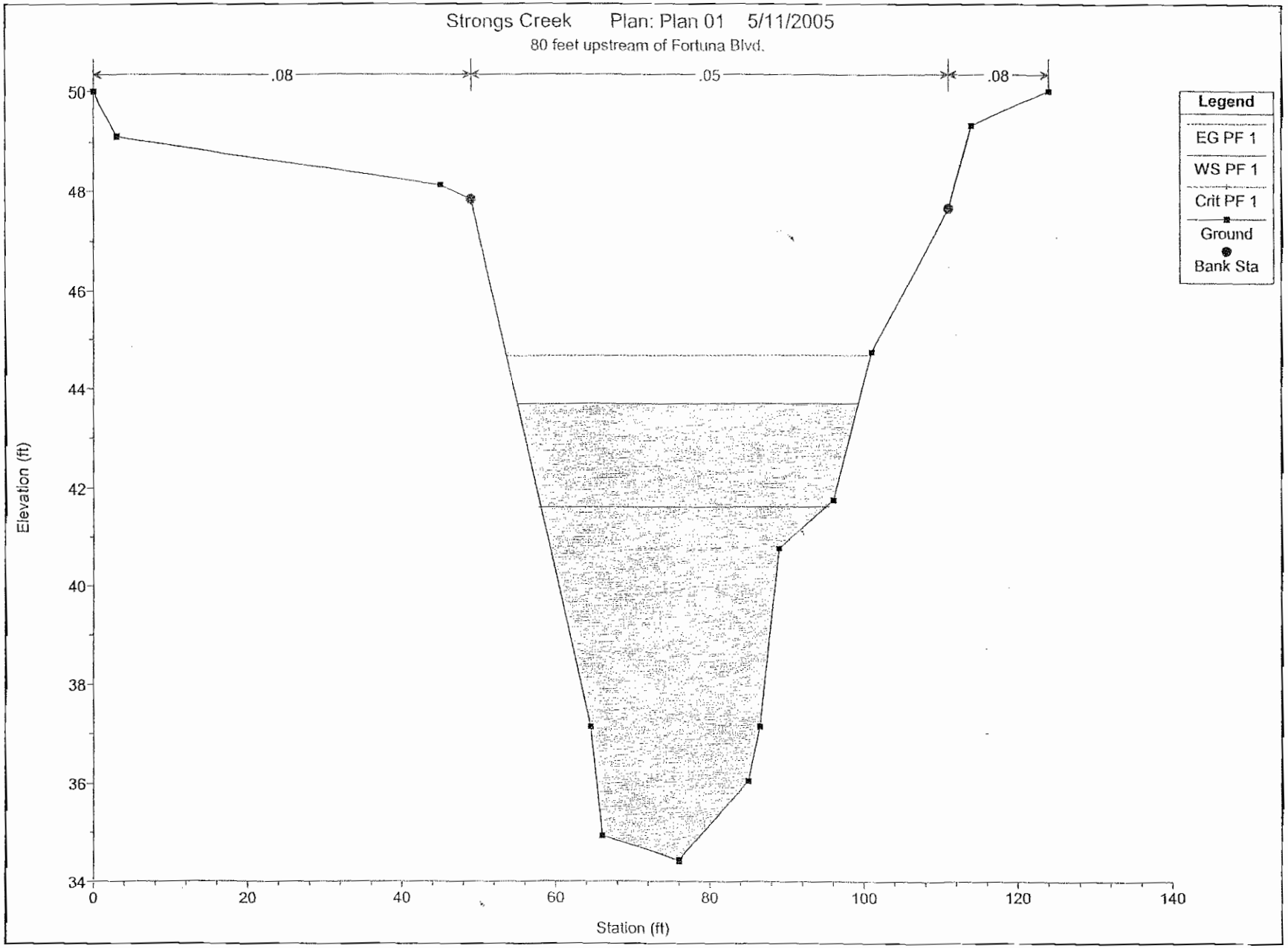

Strongs Creek Plan: Plan 01 5/11/2005
930 feet Upstream from Fortuna Blvd.
.08
.05
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
52
50
48
46
44
42
40
38
36
0
20
40
60
80
100
120
Station (ft)

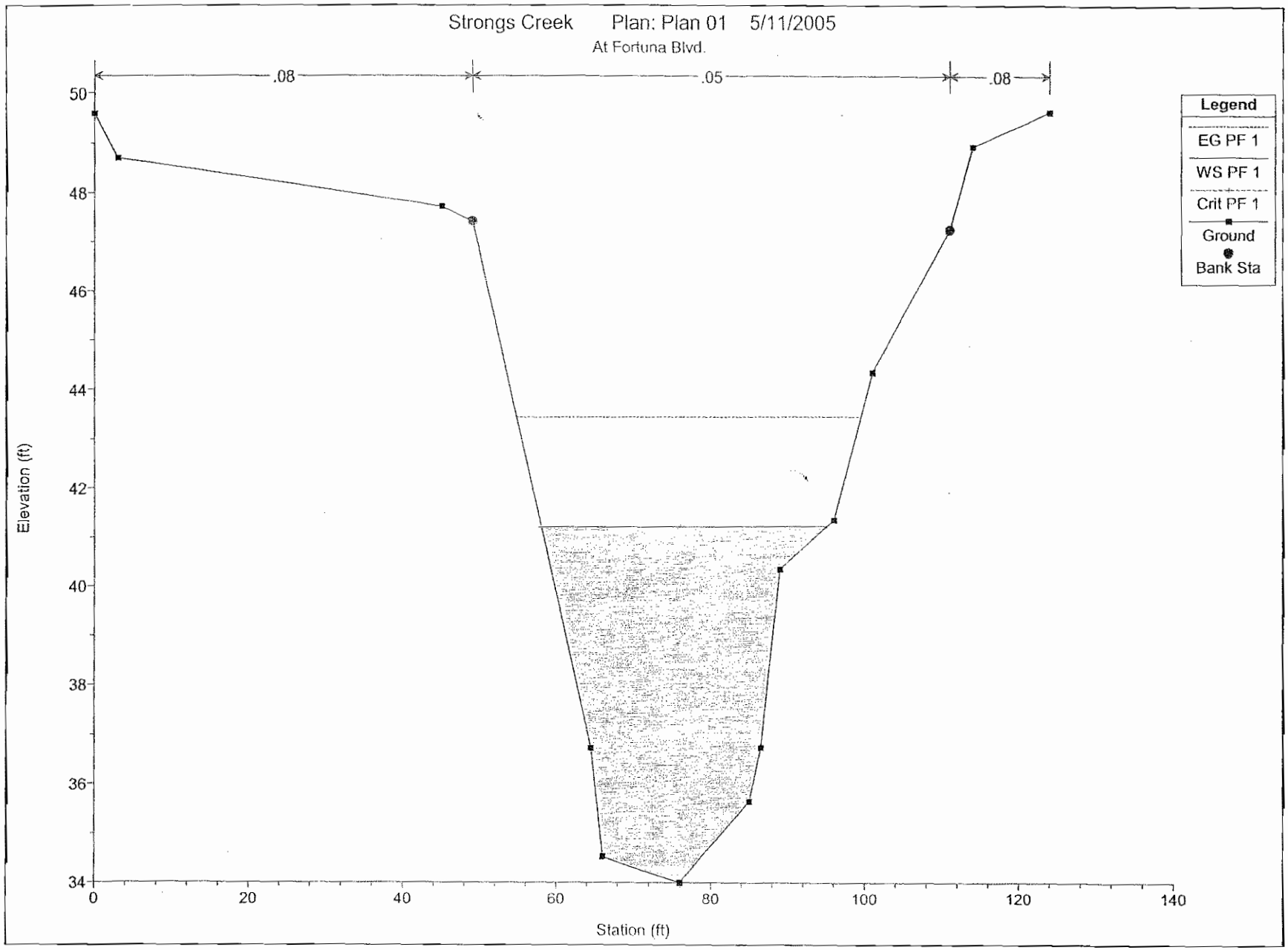

Strongs Creek Plan: Plan 01 5/11/2005
850 feet upstream of Fortuna Blvd.
.08
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
52
50
48
46
44
42
40
38
36
34
0
20
40
60
80
100
Station (ft)

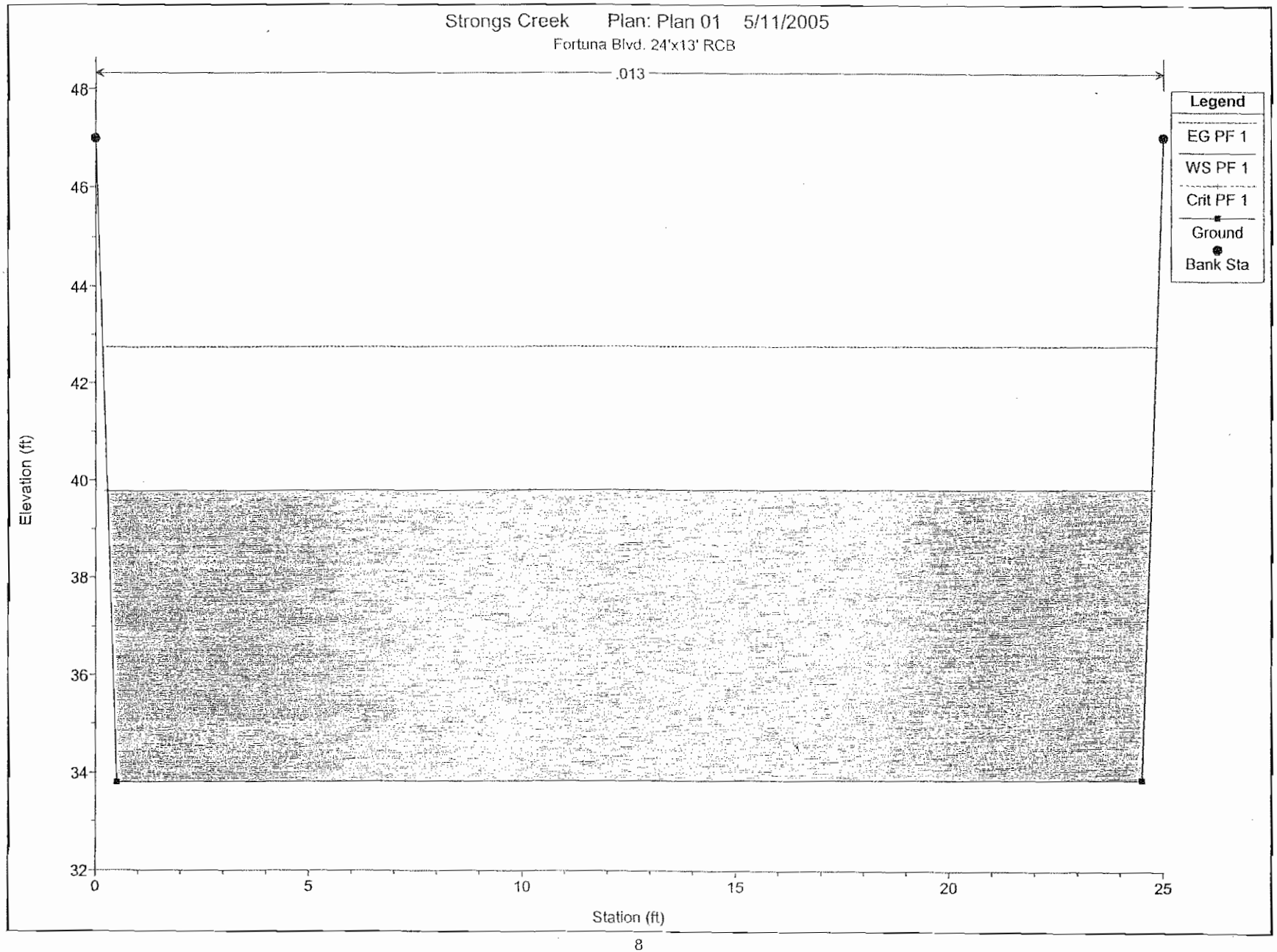

Strongs Creek Plan: Plan 01 5/11/2005
650 feet upstream of Fortuna Blvd
.08
.05
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
55
50
45
40
35
0
20
40
60
80
Station (ft)


Strongs Creek Plan: Plan 01 5/11/2005
430 feet upstream of Fortuna Blvd.
.08
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
52
50
48
46
44
42
40
38
36
34
0
20
40
60
80
100
120
Station (ft)


Strongs Creek Plan: Plan 01 5/11/2005
280 feet upstream of Fortuna Blvd.
.08
.05
.08
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
50
48
46
44
42
40
38
36
34
0
20
40
60
80
100
120
140
Station (ft)

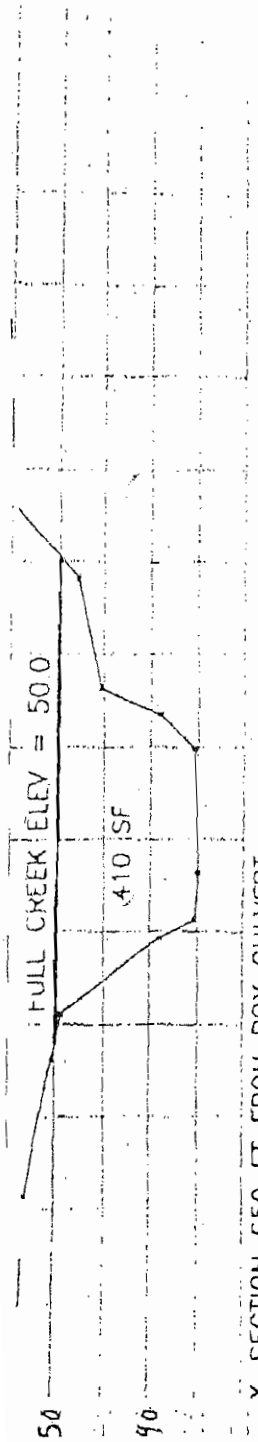

Strongs Creek Plan: Plan 01 5/11/2005
80 feet upstream of Fortuna Blvd.
.08
.05
.08
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
50
48
46
44
42
40
38
36
34
0
20
40
60
80
100
120
140
Station (ft)


Strongs Creek Plan: Plan 01 5/11/2005
At Fortuna Blvd.
.08
.05
.08
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
50
48
46
44
42
40
38
36
34
0
20
40
60
80
100
120
140
Station (ft)

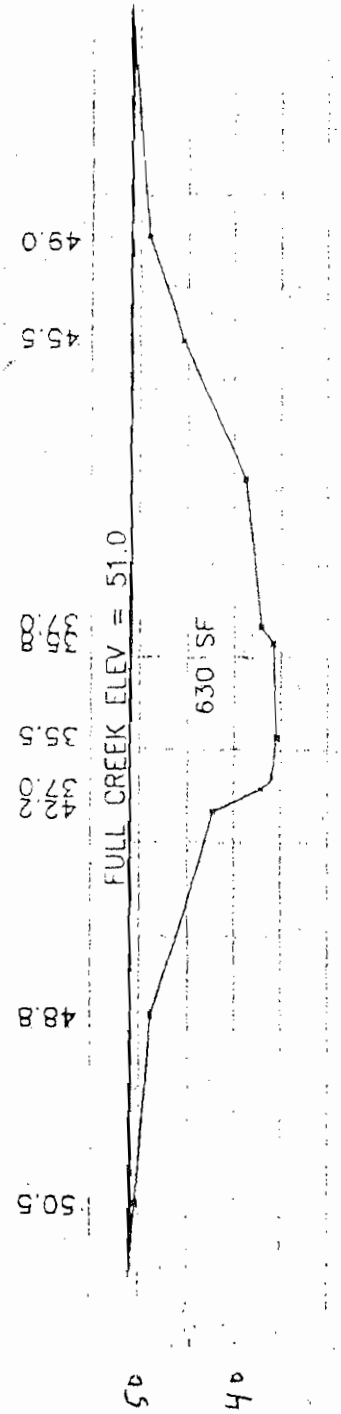

Strongs Creek Plan: Plan 01 5/11/2005
Fortuna Blvd. 24'x13' RCB
.013
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
48
46
44
42
40
38
36
34
32
0
5
10
15
20
25
Station (ft)

Strongs Creek @
Fortuna Blvd. Crossing
and Upstream
L SECTIONS

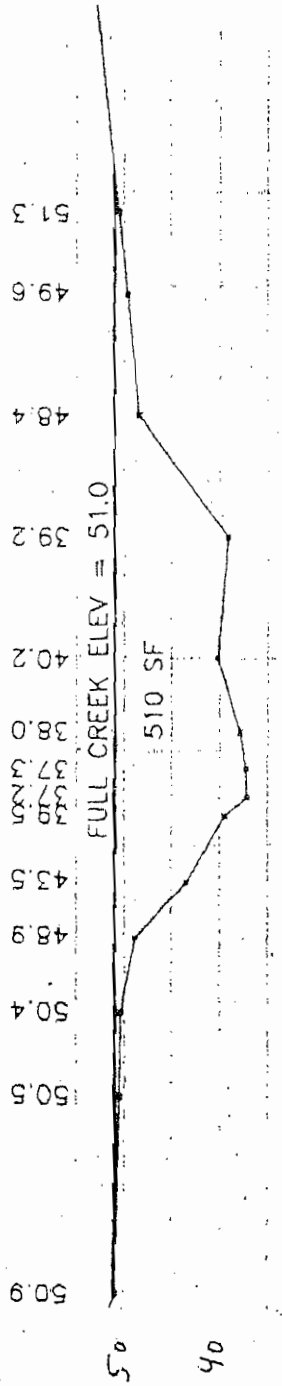
Post-it® Fax Note 7671	Date 11/22	# of pages ▶ 2
To MATT KENNEDY	From Susan Tappan	
Co./Dept. W&K	Co. Fortuna	
Phone #	Phone # 725-7600	
Fax # 444-8330	Fax # 725-7610	



X-SECTION 650 FT FROM BOX CULVERT



X-SECTION 850 FT FROM BOX CULVERT



X-SECTION 930 FT FROM BOX CULVERT

RECEIVED
NOV 19 2004
CITY OF FORTUNA

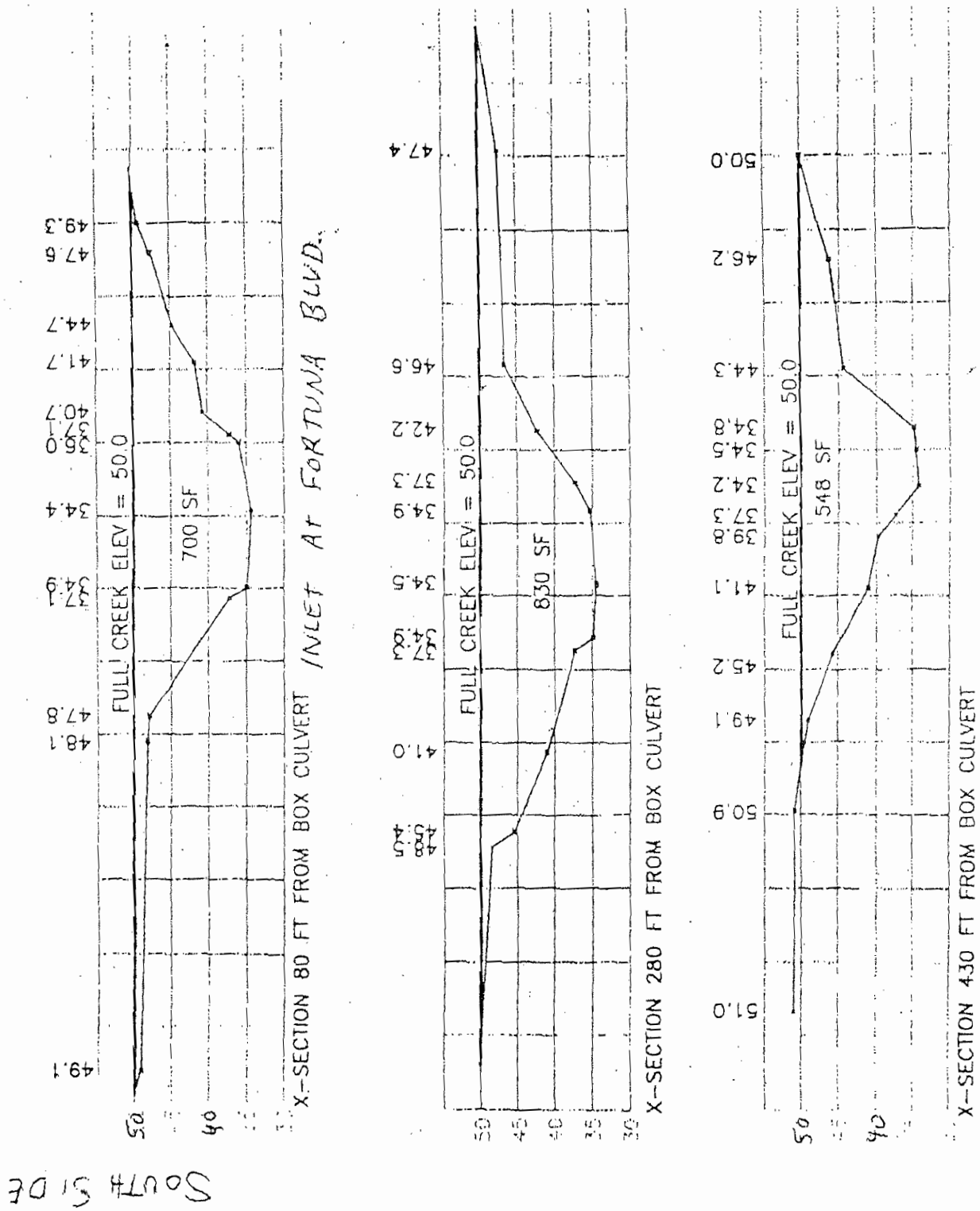
~~RECEIVED~~
~~NOV 17 2004~~
~~CITY OF FORTUNA~~

11-18-04

REGISTERED PROFESSIONAL ENGINEER
ALLAN M. BAIRD
No. 23681
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

STRONG CREEK CHAN

SCALE: 1"=20



Appendix D
POND-2 Hydraulic Model Results

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
0.00	0.0	1
0.50	0.5	1
1.00	2.9	1
1.50	3.8	1
2.00	4.6	1
2.50	5.2	1
3.00	5.8	1
3.50	6.3	1
4.00	6.8	1
4.50	7.3	1
5.00	7.7	1
5.50	8.1	1
6.00	8.5	1
6.50	8.9	2 +1
6.50	8.9	2 +1
7.00	12.8	2 +1
7.50	19.5	2 +1
7.90	25.9	2 +1

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

Outlet Structure File: c:/temp/matt/9804\PROJ9804.STR
Planimeter Input File: c:/temp/matt/9804\PROJ9804.VOL
Rating Table Output File: c:/temp/matt/9804\PROJ9804.PND

Min. Elev.(ft) = 0 Max. Elev.(ft) = 7.9 Incr.(ft) = .5

Additional elevations (ft) to be included in table:
* *
6.5

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
WEIR-VR	2		->	2
CULVERT-CR	1		->	1

Outflow rating table summary was stored in file:
c:/temp/matt/9804\PROJ9804.PND

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)? 6.5
E2 elev.(ft)? 7.901
Weir coefficient? 2.6
Weir elev.(ft)? 6.5
Length (ft)? 4
Contracted/Suppressed (C/S)? C

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	0
E2 elev.(ft)?	7.901
Diam. (ft)?	.5
Inv. el.(ft)?	0
Slope (ft/ft)?	.05
T1 ratio?	
T2 ratio?	
K Coeff.?	0.0018
M Coeff.?	2
c Coeff.?	0.003
Y Coeff.?	0.75
Form 1 or 2?	1
Slope factor?	-0.5

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

Outflow Rating Table for Structure #2
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
0.00	0.0	E < Inv.El.= 6.5
0.50	0.0	E < Inv.El.= 6.5
1.00	0.0	E < Inv.El.= 6.5
1.50	0.0	E < Inv.El.= 6.5
2.00	0.0	E < Inv.El.= 6.5
2.50	0.0	E < Inv.El.= 6.5
3.00	0.0	E < Inv.El.= 6.5
3.50	0.0	E < Inv.El.= 6.5
4.00	0.0	E < Inv.El.= 6.5
4.50	0.0	E < Inv.El.= 6.5
5.00	0.0	E < Inv.El.= 6.5
5.50	0.0	E < Inv.El.= 6.5
6.00	0.0	E < Inv.El.= 6.5
6.50	0.0	H =0.0
6.50	0.0	H =0.0
7.00	3.6	H =.5
7.50	9.9	H =1.0
7.90	16.0	H =1.4

C = 2.6 L (ft) = 4
H (ft) = Table elev. - Invert elev. (6.5 ft)
Q (cfs) = C * (L-.2H) * (H**1.5) -- Contracted Weir

Outlet Structure File: PROJ9804.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Multi-stage outlet structure consisting of a 6" outlet pipe, and a 4' wide spillway. Inlet control on the 6" drain pipe.

****

Outflow Rating Table for Structure #1
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
0.00	0.0	No headwater
0.50	0.5	Submerged: HW =.5
1.00	2.9	Submerged: HW =1.0
1.50	3.8	Submerged: HW =1.5
2.00	4.6	Submerged: HW =2.0
2.50	5.2	Submerged: HW =2.5
3.00	5.8	Submerged: HW =3.0
3.50	6.3	Submerged: HW =3.5
4.00	6.8	Submerged: HW =4.0
4.50	7.3	Submerged: HW =4.5
5.00	7.7	Submerged: HW =5.0
5.50	8.1	Submerged: HW =5.5
6.00	8.5	Submerged: HW =6.0
6.50	8.9	Submerged: HW =6.5
6.50	8.9	Submerged: HW =6.5
7.00	9.2	Submerged: HW =7.0
7.50	9.6	Submerged: HW =7.5
7.90	9.8	Submerged: HW =7.900

Used Unsubmerged Equ. Form (1) for elev. less than .51 ft
Used Submerged Equation for elevations greater than .39 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft)

at dc

Transition flows interpolated from the following values:
E1=.51 ft; Q1=.49 cfs; Dc=.35 ft; E2=.39 ft; Q2=.56 cfs

```
*********************************************************************
    *
*
    *
*
    *  Multi-stage outlet structure consisting of a 6" outlet pipe, and
*
    *      a 4' wide spillway. Inlet control on the 6" drain pipe.
*
    *
*
    *
*

*********************************************************************
```

Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Rating Table file: c:/temp/matt/9804\PROJ9804.PND

----INITIAL CONDITIONS----
Elevation = 0.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
0.00	0.0	0.000	0.0	0.0
0.50	0.5	0.153	37.0	37.5
1.00	2.9	0.308	74.6	77.5
1.50	3.8	0.466	112.8	116.6
2.00	4.6	0.626	151.5	156.1
2.50	5.2	0.789	190.9	196.1
3.00	5.8	0.954	230.8	236.6
3.50	6.3	1.121	271.3	277.6
4.00	6.8	1.291	312.4	319.2
4.50	7.3	1.463	354.1	361.4
5.00	7.7	1.638	396.4	404.1
5.50	8.1	1.815	439.3	447.4

6.00	8.5	1.995	482.9	491.4
6.50	8.9	2.178	527.0	535.9
7.00	12.8	2.363	571.8	584.6
7.50	19.5	2.551	617.2	636.7
7.90	25.9	2.703	654.0	679.9

Time increment (t) = 0.100 hrs.

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
9.000	3.00	-----	0.0	0.0	0.00	0.00
9.100	3.00	6.0	5.8	6.0	0.08	0.08
9.200	4.00	7.0	12.5	12.8	0.17	0.17
9.300	4.00	8.0	20.0	20.5	0.27	0.27
9.400	5.00	9.0	28.2	29.0	0.39	0.39
9.500	5.00	10.0	37.1	38.2	0.54	0.51
9.600	6.00	11.0	45.8	48.1	1.14	0.63
9.700	9.00	15.0	57.0	60.8	1.90	0.79
9.800	12.00	21.0	72.2	78.0	2.91	1.01
9.900	15.00	27.0	92.4	99.2	3.40	1.28
10.000	26.00	41.0	125.1	133.4	4.14	1.71
10.100	45.00	71.0	185.7	196.1	5.20	2.50
10.200	48.00	93.0	266.1	278.7	6.31	3.51
10.300	32.00	80.0	331.9	346.1	7.12	4.32
10.400	20.00	52.0	368.8	383.9	7.51	4.76
10.500	15.00	35.0	388.4	403.8	7.70	5.00
10.600	13.00	28.0	400.8	416.4	7.81	5.14
10.700	11.00	24.0	409.0	424.8	7.89	5.24
10.800	9.00	20.0	413.2	429.0	7.93	5.29
10.900	8.00	17.0	414.3	430.2	7.94	5.30
11.000	8.00	16.0	414.4	430.3	7.94	5.30
11.100	8.00	16.0	414.5	430.4	7.94	5.30

11.200	7.00	15.0	413.7	429.5	7.93	5.29
11.300	7.00	14.0	411.8	427.7	7.92	5.27
11.400	7.00	14.0	410.0	425.8	7.90	5.25
11.500	7.00	14.0	408.2	424.0	7.88	5.23
11.600	6.00	13.0	405.5	421.2	7.86	5.20
11.700	6.00	12.0	401.9	417.5	7.82	5.16
11.800	6.00	12.0	398.3	413.9	7.79	5.11
11.900	6.00	12.0	394.8	410.3	7.76	5.07
12.000	6.00	12.0	391.3	406.8	7.72	5.03
12.100	6.00	12.0	388.0	403.3	7.69	4.99
12.200	6.00	12.0	384.6	400.0	7.66	4.95
12.300	6.00	12.0	381.4	396.6	7.63	4.91
12.400	6.00	12.0	378.2	393.4	7.60	4.87
12.500	5.00	11.0	374.1	389.2	7.56	4.83
12.600	5.00	10.0	369.0	384.1	7.51	4.77
12.700	5.00	10.0	364.1	379.0	7.47	4.71
12.800	5.00	10.0	359.3	374.1	7.42	4.65
12.900	5.00	10.0	354.5	369.3	7.37	4.59
13.000	5.00	10.0	349.9	364.5	7.33	4.54
13.100	5.00	10.0	345.3	359.9	7.28	4.48
13.200	5.00	10.0	340.8	355.3	7.23	4.43
13.300	4.00	9.0	335.5	349.8	7.16	4.36
13.400	4.00	8.0	329.3	343.5	7.09	4.29

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)		I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
13.500	4.00		8.0	323.3	337.3	7.02	4.22
13.600	4.00		8.0	317.4	331.3	6.94	4.14
13.700	4.00		8.0	311.7	325.4	6.87	4.07
13.800	4.00		8.0	306.0	319.7	6.81	4.01
13.900	4.00		8.0	300.6	314.0	6.74	3.94
14.000	4.00		8.0	295.2	308.6	6.67	3.87
14.100	4.00		8.0	290.0	303.2	6.61	3.81
14.200	4.00		8.0	284.9	298.0	6.55	3.75
14.300	4.00		8.0	279.9	292.9	6.48	3.68
14.400	4.00		8.0	275.1	287.9	6.42	3.62
14.500	4.00		8.0	270.4	283.1	6.37	3.57
14.600	4.00		8.0	265.7	278.4	6.31	3.51
14.700	4.00		8.0	261.2	273.7	6.25	3.45
14.800	3.00		7.0	255.9	268.2	6.19	3.39
14.900	3.00		6.0	249.7	261.9	6.11	3.31
15.000	3.00		6.0	243.6	255.7	6.03	3.23
15.100	3.00		6.0	237.7	249.6	5.96	3.16
15.200	3.00		6.0	231.9	243.7	5.89	3.09
15.300	3.00		6.0	226.3	237.9	5.82	3.02
15.400	3.00		6.0	220.8	232.3	5.74	2.95
15.500	3.00		6.0	215.5	226.8	5.65	2.88
15.600	3.00		6.0	210.3	221.5	5.58	2.81

15.700	3.00		6.0	205.3	216.3	5.50	2.75
15.800	3.00		6.0	200.5	211.3	5.43	2.69
15.900	3.00		6.0	195.8	206.5	5.35	2.63
16.000	3.00		6.0	191.2	201.8	5.28	2.57
16.100	3.00		6.0	186.8	197.2	5.22	2.51
16.200	3.00		6.0	182.5	192.8	5.15	2.46
16.300	3.00		6.0	178.3	188.5	5.09	2.40
16.400	3.00		6.0	174.2	184.3	5.02	2.35
16.500	3.00		6.0	170.3	180.2	4.96	2.30
16.600	3.00		6.0	166.5	176.3	4.90	2.25
16.700	3.00		6.0	162.8	172.5	4.85	2.21
16.800	3.00		6.0	159.2	168.8	4.79	2.16
16.900	3.00		6.0	155.8	165.2	4.74	2.11
17.000	3.00		6.0	152.4	161.8	4.68	2.07
17.100	3.00		6.0	149.1	158.4	4.63	2.03
17.200	3.00		6.0	146.0	155.1	4.58	1.99
17.300	3.00		6.0	142.9	152.0	4.52	1.95
17.400	3.00		6.0	140.0	148.9	4.45	1.91
17.500	3.00		6.0	137.2	146.0	4.40	1.87
17.600	3.00		6.0	134.6	143.2	4.34	1.84
17.700	3.00		6.0	132.0	140.6	4.29	1.80
17.800	3.00		6.0	129.5	138.0	4.23	1.77
17.900	3.00		6.0	127.2	135.5	4.18	1.74
18.000	3.00		6.0	124.9	133.2	4.14	1.71

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
18.100	3.00	6.0	122.7	130.9	4.09	1.68
18.200	3.00	6.0	120.6	128.7	4.05	1.65
18.300	3.00	6.0	118.6	126.6	4.00	1.63
18.400	3.00	6.0	116.7	124.6	3.96	1.60
18.500	3.00	6.0	114.8	122.7	3.92	1.58
18.600	3.00	6.0	113.1	120.8	3.89	1.55
18.700	3.00	6.0	111.4	119.1	3.85	1.53
18.800	3.00	6.0	109.7	117.4	3.82	1.51
18.900	3.00	6.0	108.2	115.7	3.78	1.49
19.000	2.00	5.0	105.7	113.2	3.72	1.46
19.100	2.00	4.0	102.4	109.7	3.64	1.41
19.200	2.00	4.0	99.3	106.4	3.57	1.37
19.300	2.00	4.0	96.3	103.3	3.49	1.33
19.400	2.00	4.0	93.5	100.3	3.43	1.29
19.500	2.00	4.0	90.7	97.5	3.36	1.26
19.600	2.00	4.0	88.1	94.7	3.30	1.22
19.700	2.00	4.0	85.7	92.1	3.24	1.19
19.800	2.00	4.0	83.3	89.7	3.18	1.16
19.900	2.00	4.0	81.1	87.3	3.13	1.13
20.000	2.00	4.0	78.9	85.1	3.07	1.10
20.100	2.00	4.0	76.9	82.9	3.02	1.07
20.200	2.00	4.0	74.9	80.9	2.98	1.04

20.300	2.00	4.0	73.0	78.9	2.93	1.02
20.400	2.00	4.0	71.3	77.0	2.87	0.99
20.500	2.00	4.0	69.8	75.3	2.77	0.97
20.600	2.00	4.0	68.4	73.8	2.68	0.95
20.700	2.00	4.0	67.2	72.4	2.59	0.94
20.800	2.00	4.0	66.2	71.2	2.52	0.92
20.900	2.00	4.0	65.3	70.2	2.46	0.91
21.000	2.00	4.0	64.4	69.3	2.41	0.90
21.100	2.00	4.0	63.7	68.4	2.36	0.89
21.200	2.00	4.0	63.1	67.7	2.31	0.88
21.300	2.00	4.0	62.6	67.1	2.28	0.87
21.400	2.00	4.0	62.1	66.6	2.24	0.86
21.500	2.00	4.0	61.6	66.1	2.21	0.86
21.600	2.00	4.0	61.3	65.6	2.19	0.85
21.700	2.00	4.0	60.9	65.3	2.17	0.85
21.800	2.00	4.0	60.6	64.9	2.15	0.84
21.900	2.00	4.0	60.4	64.6	2.13	0.84
22.000	2.00	4.0	60.2	64.4	2.11	0.84
22.100	2.00	4.0	60.0	64.2	2.10	0.83
22.200	2.00	4.0	59.8	64.0	2.09	0.83
22.300	2.00	4.0	59.6	63.8	2.08	0.83
22.400	2.00	4.0	59.5	63.6	2.07	0.83
22.500	2.00	4.0	59.4	63.5	2.06	0.82
22.600	2.00	4.0	59.3	63.4	2.05	0.82

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
22.700	2.00	4.0	59.2	63.3	2.05	0.82
22.800	2.00	4.0	59.1	63.2	2.04	0.82
22.900	2.00	4.0	59.0	63.1	2.04	0.82
23.000	2.00	4.0	59.0	63.0	2.03	0.82
23.100	2.00	4.0	58.9	63.0	2.03	0.82
23.200	2.00	4.0	58.9	62.9	2.02	0.82
23.300	2.00	4.0	58.8	62.9	2.02	0.82
23.400	2.00	4.0	58.8	62.8	2.02	0.82
23.500	2.00	4.0	58.8	62.8	2.02	0.82
23.600	2.00	4.0	58.7	62.8	2.01	0.82
23.700	2.00	4.0	58.7	62.7	2.01	0.82
23.800	2.00	4.0	58.7	62.7	2.01	0.81
23.900	2.00	4.0	58.7	62.7	2.01	0.81

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD

Starting Pond W.S. Elevation = 0.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	48.00 cfs
Peak Outflow	=	7.94 cfs
Peak Elevation	=	5.30 ft

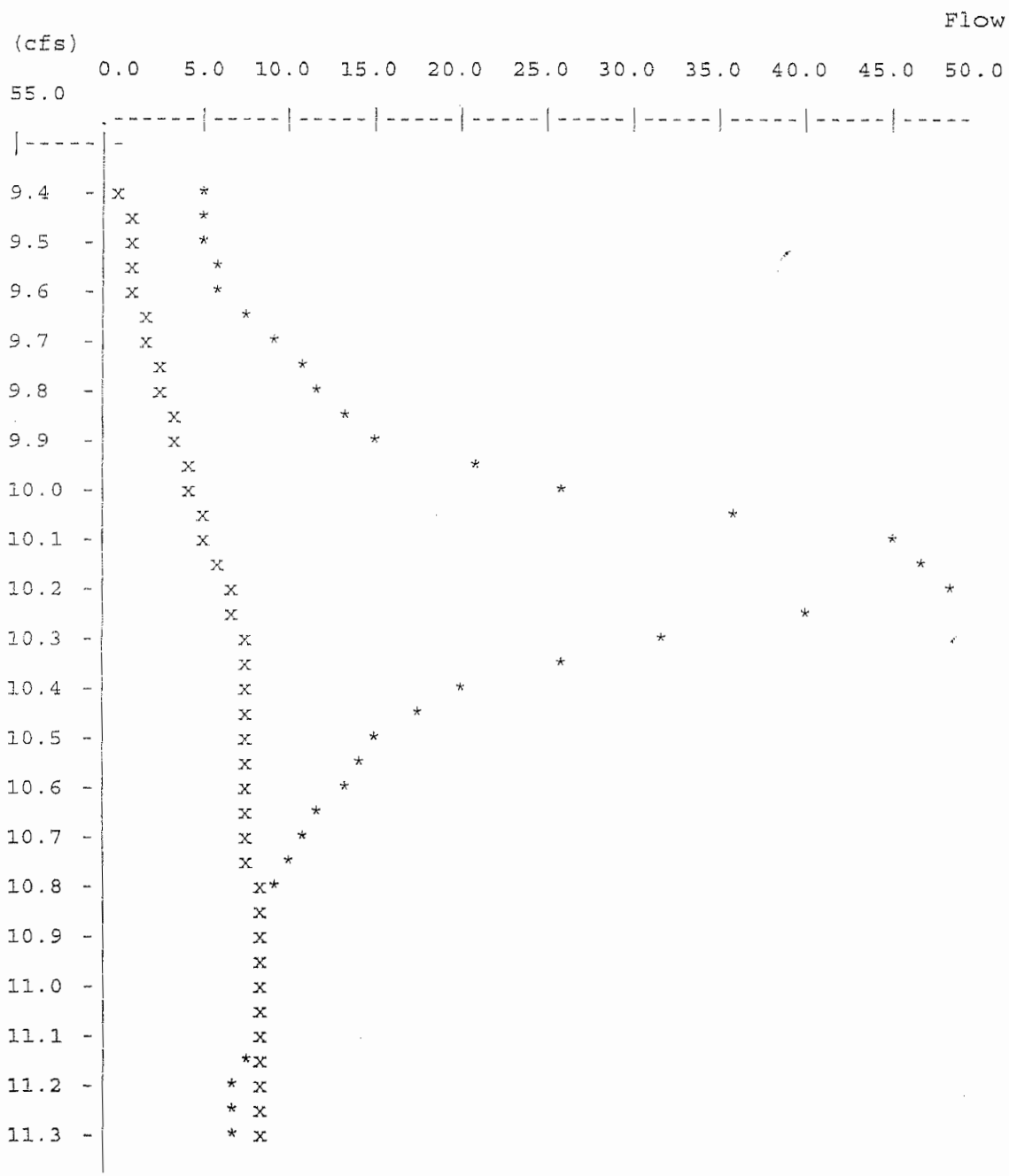
***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	1.75 ac-ft
Total Storage in Pond	=	1.75 ac-ft

Warning: Inflow hydrograph truncated on left side.
Warning: Inflow hydrograph truncated on right side.

Pond File: c:/temp/matt/9804\PROJ9804.PND
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Outflow Hydrograph: c:/temp/matt/9804\OUT .HYD
EXECUTED: 04-01-2005 13:30:17

Peak Inflow = 48.00 cfs
Peak Outflow = 7.94 cfs
Peak Elevation = 5.30 ft



```
(hrs)

*  File:  c:/temp/matt/9804\HYDR9804.HYD    Qmax =    48.0 cfs
x  File:  c:/temp/matt/9804\OUT      .HYD    Qmax =     7.9 cfs
```

POND-2 Version: 5.21 S/N:

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

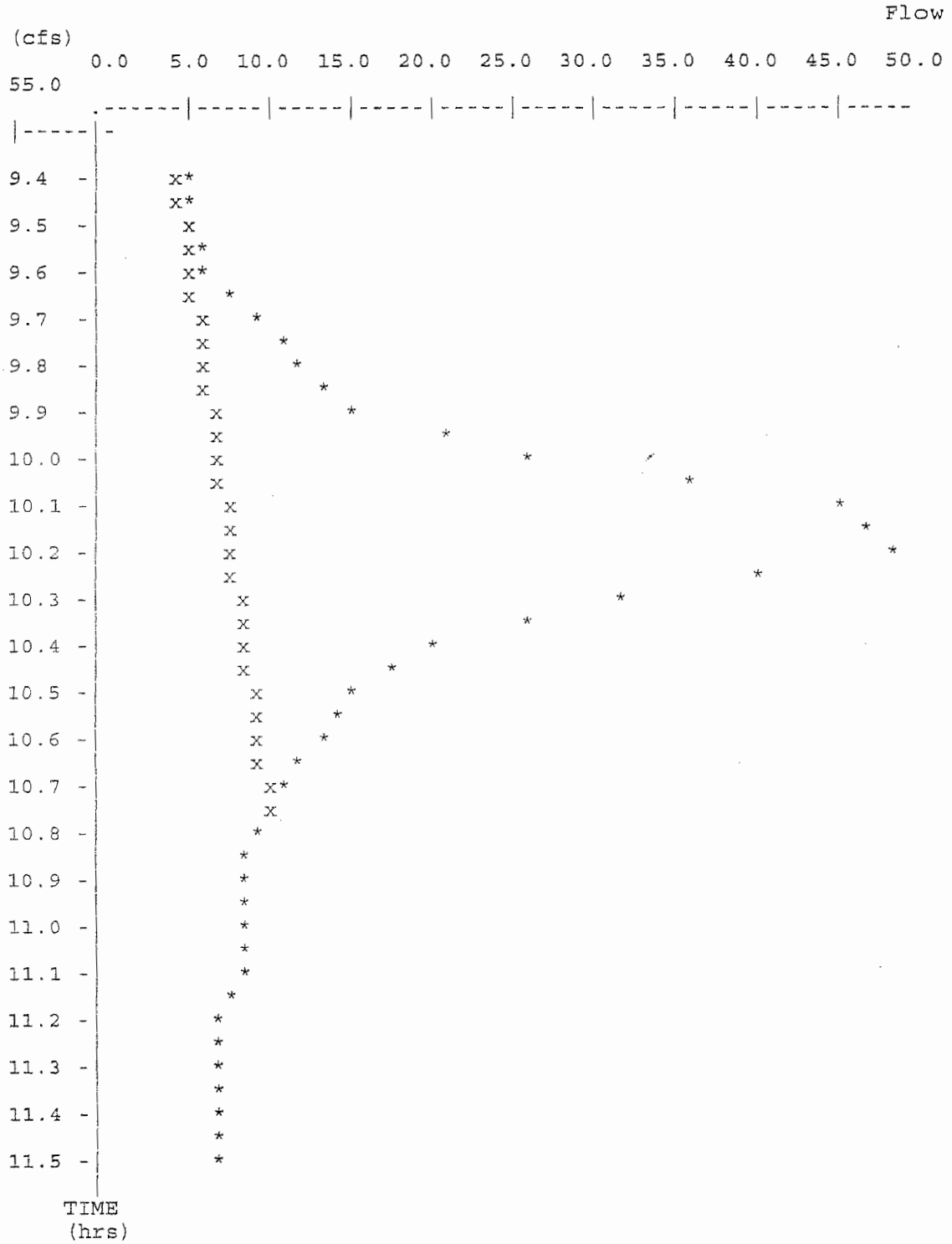
Inflow Hydrograph: c:/temp/matt/9804\HYDR9804.HYD
Qpeak = 48.0 cfs

Estimated Outflow: c:/temp/matt/9804\ESTIMATE.EST
Qpeak = 10.0 cfs

Approximate Storage Volume
(computed from t= 9.10 to 10.75 hrs)

1.4 acre-ft

POND-2 Version: 5.21 S/N:
Plotted: 04-01-2005



* File: c:/temp/matt/9804\HYDR9804.HYD Qmax = 48.0 cfs
x File: c:/temp/matt/9804\ESTIMATE.EST Qmax = 10.0 cfs

POND-2 Version: 5.21 S/N:

>>>>> OUTFLOW HYDROGRAPH ESTIMATOR <<<<<

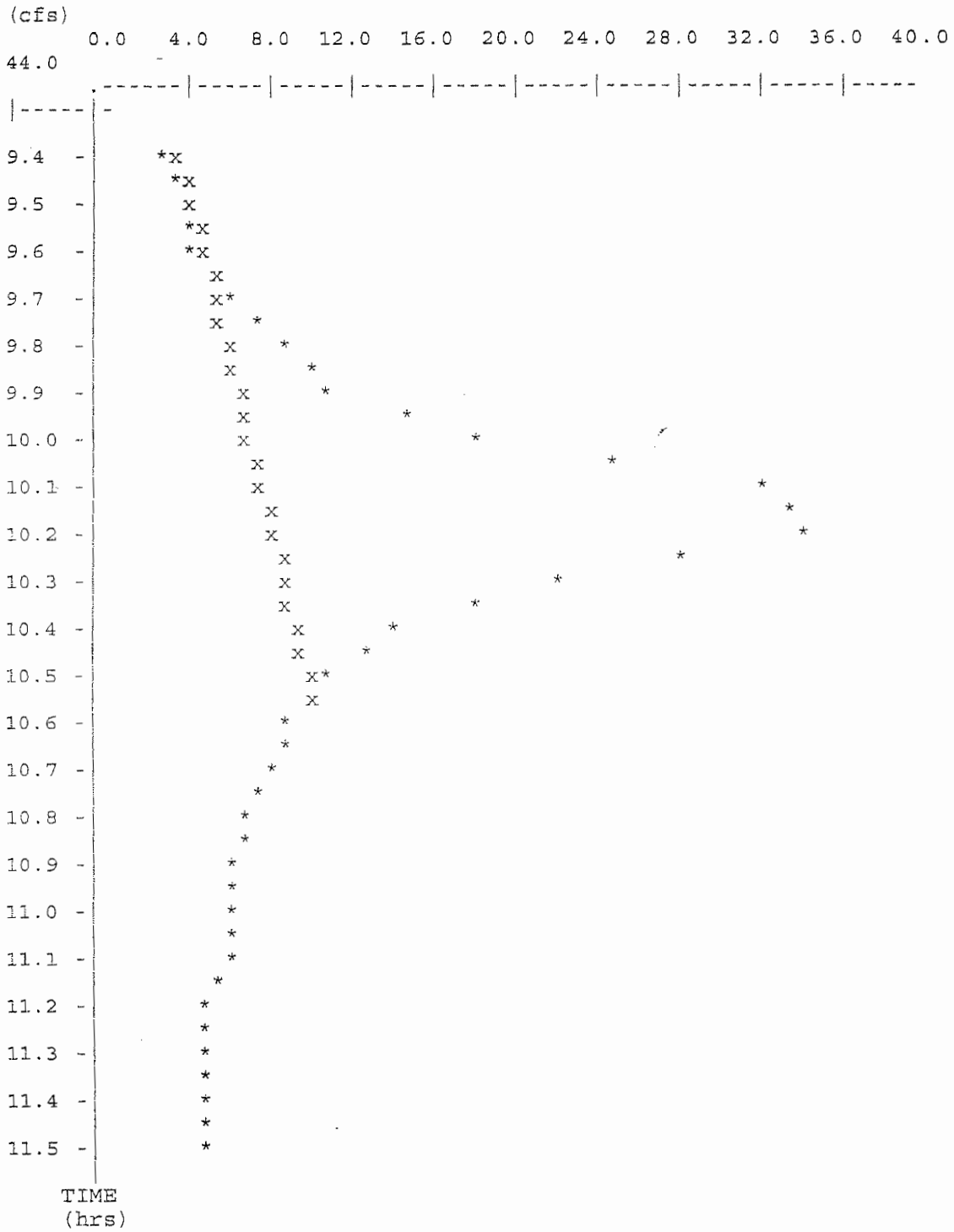
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Qpeak = 34.0 cfs

Estimated Outflow: c:/temp/matt/9809\ESTIMATE.EST
Qpeak = 10.0 cfs

Approximate Storage Volume
(computed from t= 9.10 to 10.55 hrs)

0.7 acre-ft

POND-2 Version: 5.21 S/N:
Plotted: 04-01-2005



* File: c:/temp/matt/9809\HYDR9809.HYD Qmax = 34.0 cfs
x File: c:/temp/matt/9809\ESTIMATE.EST Qmax = 10.0 cfs

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
0.00	0.0	1
0.25	0.3	1
0.50	0.9	1
0.75	1.7	1
1.00	2.7	1
1.25	3.3	1
1.50	4.1	1
1.75	4.6	1
2.00	5.2	1
2.25	5.7	1
2.50	6.1	1
2.75	6.5	1
3.00	6.9	1
3.00	6.9	1
3.25	7.2	1
3.50	7.6	1
3.75	7.9	1
4.00	8.2	1
4.25	8.5	1
4.50	8.8	2 +1
4.75	10.4	2 +1
5.00	13.0	2 +1
5.25	16.2	2 +1
5.50	19.8	2 +1
5.75	23.8	2 +1
6.00	28.1	2 +1

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

Outlet Structure File: c:/temp/matt/9809\PROJ9809.STR
Planimeter Input File: c:/temp/matt/9809\PROJ9809.VOL
Rating Table Output File: c:/temp/matt/9809\PROJ9809.PND

Min. Elev.(ft) = 0 Max. Elev.(ft) = 6 Incr.(ft) = .25

Additional elevations (ft) to be included in table:
* *
3

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
WEIR-VR	2		->	2
CULVERT-CR	1		->	1

Outflow rating table summary was stored in file:
c:/temp/matt/9809\PROJ9809.PND

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)? 4.5
E2 elev.(ft)? 6.001
Weir coefficient? 2.6
Weir elev.(ft)? 4.5
Length (ft)? 4
Contracted/Suppressed (C/S)? C

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	0
E2 elev.(ft)?	6.001
Diam. (ft)?	1.0
Inv. el.(ft)?	0
Slope (ft/ft)?	0.10
T1 ratio?	
T2 ratio?	
K Coeff.?	0.0018
M Coeff.?	2
c Coeff.?	0.03
Y Coeff.?	0.75
Form 1 or 2?	1
Slope factor?	-0.5

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

Outflow Rating Table for Structure #2
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
0.00	0.0	E < Inv.El.= 4.5
0.25	0.0	E < Inv.El.= 4.5
0.50	0.0	E < Inv.El.= 4.5
0.75	0.0	E < Inv.El.= 4.5
1.00	0.0	E < Inv.El.= 4.5
1.25	0.0	E < Inv.El.= 4.5
1.50	0.0	E < Inv.El.= 4.5
1.75	0.0	E < Inv.El.= 4.5
2.00	0.0	E < Inv.El.= 4.5
2.25	0.0	E < Inv.El.= 4.5
2.50	0.0	E < Inv.El.= 4.5
2.75	0.0	E < Inv.El.= 4.5
3.00	0.0	E < Inv.El.= 4.5
3.00	0.0	E < Inv.El.= 4.5
3.25	0.0	E < Inv.El.= 4.5
3.50	0.0	E < Inv.El.= 4.5
3.75	0.0	E < Inv.El.= 4.5
4.00	0.0	E < Inv.El.= 4.5
4.25	0.0	E < Inv.El.= 4.5
4.50	0.0	H =0.0
4.75	1.3	H =.25
5.00	3.6	H =.5
5.25	6.5	H =.750
5.50	9.9	H =1.0
5.75	13.6	H =1.25
6.00	17.7	H =1.5

C = 2.6 L (ft) = 4
H (ft) = Table elev. - Invert elev. (4.5 ft)
Q (cfs) = C * (L-.2H) * (H**1.5) -- Contracted Weir

Outlet Structure File: PROJ9809.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****
Circular detention basin with a 1' outlet pipe at the bottom and a 4' wide spillway.

****

Outflow Rating Table for Structure #1
CULVERT-CR Circular Culvert (With Inlet Control)

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages		
0.00	0.0	No headwater		
0.25	0.3	Equ.1: HW =.25	dc=.217	Ac=.126
0.50	0.9	Equ.1: HW =.5	dc=.401	Ac=.294
0.75	1.7	Equ.1: HW =.750	dc=.557	Ac=.45
1.00	2.7	Equ.1: HW =1.0	dc=.7	Ac=.587
1.25	3.3	Submerged: HW =1.25		
1.50	4.1	Submerged: HW =1.5		
1.75	4.6	Submerged: HW =1.75		
2.00	5.2	Submerged: HW =2.0		
2.25	5.7	Submerged: HW =2.25		
2.50	6.1	Submerged: HW =2.5		
2.75	6.5	Submerged: HW =2.75		
3.00	6.9	Submerged: HW =3.0		
3.00	6.9	Submerged: HW =3.0		
3.25	7.2	Submerged: HW =3.25		
3.50	7.6	Submerged: HW =3.5		
3.75	7.9	Submerged: HW =3.75		
4.00	8.2	Submerged: HW =4.0		
4.25	8.5	Submerged: HW =4.25		
4.50	8.8	Submerged: HW =4.5		
4.75	9.1	Submerged: HW =4.75		
5.00	9.4	Submerged: HW =5.0		
5.25	9.7	Submerged: HW =5.25		
5.50	9.9	Submerged: HW =5.5		
5.75	10.2	Submerged: HW =5.75		
6.00	10.4	Submerged: HW =6.0		

Used Unsubmerged Equ. Form (1) for elev. less than 1.01 ft
Used Submerged Equation for elevations greater than 1.18 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=1.01 ft; Q1=2.75 cfs; Dc=.71 ft; E2=1.18 ft; Q2=3.14 cfs

```
*********************************************************************
    *
*
    *  Circular detention basin with a 1' outlet pipe at the bottom and
*
    *                        a 4' wide spillway.
*
    *
*
    *
*
    *
*
*********************************************************************
```

Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Rating Table file: c:/temp/matt/9809\PROJ9809.PND

----INITIAL CONDITIONS----
Elevation = 0.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
0.00	0.0	0.000	0.0	0.0
0.25	0.3	0.076	18.4	18.7
0.50	0.9	0.153	37.0	37.9
0.75	1.7	0.230	55.7	57.4
1.00	2.7	0.308	74.6	77.3
1.25	3.3	0.387	93.6	96.9
1.50	4.1	0.466	112.8	116.9
1.75	4.6	0.546	132.1	136.7
2.00	5.2	0.626	151.5	156.7
2.25	5.7	0.707	171.1	176.8
2.50	6.1	0.789	190.9	197.0
2.75	6.5	0.871	210.8	217.3

3.00	6.9	0.954	230.8	237.7
3.25	7.2	1.037	250.9	258.1
3.50	7.6	1.121	271.3	278.9
3.75	7.9	1.206	291.7	299.6
4.00	8.2	1.291	312.4	320.6
4.25	8.5	1.377	333.1	341.6
4.50	8.8	1.463	354.1	362.9
4.75	10.4	1.550	375.2	385.6
5.00	13.0	1.638	396.4	409.4
5.25	16.2	1.726	417.8	434.0
5.50	19.8	1.815	439.3	459.1
5.75	23.8	1.905	461.0	484.8
6.00	28.1	1.995	482.9	511.0

Time increment (t) = 0.100 hrs.

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
9.000	2.00	-----	0.0	0.0	0.00	0.00
9.100	2.00	4.0	3.9	4.0	0.06	0.05
9.200	3.00	5.0	8.6	8.9	0.14	0.12
9.300	3.00	6.0	14.1	14.6	0.23	0.19
9.400	3.00	6.0	19.4	20.1	0.34	0.27
9.500	4.00	7.0	25.4	26.4	0.54	0.35
9.600	4.00	8.0	31.8	33.4	0.76	0.44
9.700	6.00	10.0	39.7	41.8	1.06	0.55
9.800	9.00	15.0	51.5	54.7	1.59	0.72
9.900	11.00	20.0	66.7	71.5	2.41	0.93
10.000	18.00	29.0	89.2	95.7	3.26	1.23
10.100	32.00	50.0	129.8	139.2	4.68	1.78
10.200	34.00	66.0	183.7	195.8	6.08	2.49
10.300	22.00	56.0	225.8	239.7	6.93	3.02
10.400	14.00	36.0	247.3	261.8	7.27	3.29
10.500	11.00	25.0	257.3	272.3	7.47	3.42
10.600	9.00	20.0	262.2	277.3	7.57	3.48
10.700	8.00	17.0	264.0	279.2	7.60	3.50
10.800	7.00	15.0	263.8	279.0	7.60	3.50
10.900	6.00	13.0	261.7	276.8	7.56	3.47
11.000	6.00	12.0	258.7	273.7	7.50	3.44
11.100	6.00	12.0	255.8	270.7	7.44	3.40

11.200	5.00	11.0	252.1	266.8	7.37	3.35
11.300	5.00	10.0	247.5	262.1	7.28	3.30
11.400	5.00	10.0	243.1	257.5	7.19	3.24
11.500	5.00	10.0	238.9	253.1	7.13	3.19
11.600	5.00	10.0	234.7	248.9	7.06	3.14
11.700	4.00	9.0	229.8	243.7	6.99	3.07
11.800	4.00	8.0	224.0	237.8	6.90	3.00
11.900	4.00	8.0	218.4	232.0	6.79	2.93
12.000	4.00	8.0	213.0	226.4	6.68	2.86
12.100	4.00	8.0	207.9	221.0	6.57	2.80
12.200	4.00	8.0	202.9	215.9	6.47	2.73
12.300	4.00	8.0	198.2	210.9	6.38	2.67
12.400	4.00	8.0	193.6	206.2	6.28	2.61
12.500	4.00	8.0	189.2	201.6	6.19	2.56
12.600	4.00	8.0	185.0	197.2	6.11	2.50
12.700	4.00	8.0	181.0	193.0	6.02	2.45
12.800	4.00	8.0	177.1	189.0	5.94	2.40
12.900	3.00	7.0	172.4	184.1	5.84	2.34
13.000	3.00	6.0	166.9	178.4	5.73	2.27
13.100	3.00	6.0	161.7	172.9	5.60	2.20
13.200	3.00	6.0	156.8	167.7	5.47	2.14
13.300	3.00	6.0	152.1	162.8	5.35	2.08
13.400	3.00	6.0	147.6	158.1	5.23	2.02

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
13.500	3.00	6.0	143.4	153.6	5.11	1.96
13.600	3.00	6.0	139.4	149.4	4.98	1.91
13.700	3.00	6.0	135.7	145.4	4.86	1.86
13.800	3.00	6.0	132.2	141.7	4.75	1.81
13.900	3.00	6.0	128.9	138.2	4.65	1.77
14.000	3.00	6.0	125.8	134.9	4.56	1.73
14.100	3.00	6.0	122.9	131.8	4.48	1.69
14.200	3.00	6.0	120.1	128.9	4.40	1.65
14.300	3.00	6.0	117.4	126.1	4.33	1.62
14.400	3.00	6.0	114.9	123.4	4.26	1.58
14.500	3.00	6.0	112.5	120.9	4.20	1.55
14.600	3.00	6.0	110.2	118.5	4.14	1.52
14.700	3.00	6.0	108.0	116.2	4.07	1.49
14.800	2.00	5.0	105.1	113.0	3.95	1.45
14.900	2.00	4.0	101.6	109.1	3.79	1.40
15.000	2.00	4.0	98.3	105.6	3.65	1.36
15.100	2.00	4.0	95.2	102.3	3.51	1.32
15.200	2.00	4.0	92.4	99.2	3.39	1.28
15.300	2.00	4.0	89.9	96.4	3.29	1.24
15.400	2.00	4.0	87.5	93.9	3.21	1.21
15.500	2.00	4.0	85.2	91.5	3.13	1.18
15.600	2.00	4.0	83.1	89.2	3.06	1.15

15.700	2.00	4.0	81.1	87.1	3.00	1.12
15.800	2.00	4.0	79.2	85.1	2.94	1.10
15.900	2.00	4.0	77.4	83.2	2.88	1.08
16.000	2.00	4.0	75.8	81.4	2.83	1.05
16.100	2.00	4.0	74.2	79.8	2.78	1.03
16.200	2.00	4.0	72.8	78.2	2.73	1.01
16.300	2.00	4.0	71.4	76.8	2.67	0.99
16.400	2.00	4.0	70.2	75.4	2.61	0.98
16.500	2.00	4.0	69.1	74.2	2.54	0.96
16.600	2.00	4.0	68.1	73.1	2.49	0.95
16.700	2.00	4.0	67.3	72.1	2.44	0.94
16.800	2.00	4.0	66.5	71.3	2.40	0.92
16.900	2.00	4.0	65.8	70.5	2.36	0.91
17.000	2.00	4.0	65.1	69.8	2.32	0.91
17.100	2.00	4.0	64.5	69.1	2.29	0.90
17.200	2.00	4.0	64.0	68.5	2.26	0.89
17.300	2.00	4.0	63.6	68.0	2.23	0.88
17.400	2.00	4.0	63.1	67.6	2.21	0.88
17.500	2.00	4.0	62.8	67.1	2.19	0.87
17.600	2.00	4.0	62.4	66.8	2.17	0.87
17.700	2.00	4.0	62.1	66.4	2.15	0.86
17.800	2.00	4.0	61.8	66.1	2.14	0.86
17.900	2.00	4.0	61.6	65.8	2.12	0.86
18.000	2.00	4.0	61.4	65.6	2.11	0.85

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
18.100	2.00	4.0	61.2	65.4	2.10	0.85
18.200	2.00	4.0	61.0	65.2	2.09	0.85
18.300	2.00	4.0	60.8	65.0	2.08	0.85
18.400	2.00	4.0	60.7	64.8	2.07	0.84
18.500	2.00	4.0	60.6	64.7	2.07	0.84
18.600	2.00	4.0	60.4	64.6	2.06	0.84
18.700	2.00	4.0	60.3	64.4	2.05	0.84
18.800	2.00	4.0	60.2	64.3	2.05	0.84
18.900	2.00	4.0	60.2	64.2	2.04	0.84
19.000	2.00	4.0	60.1	64.2	2.04	0.83
19.100	2.00	4.0	60.0	64.1	2.03	0.83
19.200	2.00	4.0	60.0	64.0	2.03	0.83
19.300	2.00	4.0	59.9	64.0	2.03	0.83
19.400	2.00	4.0	59.8	63.9	2.03	0.83
19.500	2.00	4.0	59.8	63.8	2.02	0.83
19.600	2.00	4.0	59.8	63.8	2.02	0.83
19.700	2.00	4.0	59.7	63.8	2.02	0.83
19.800	2.00	4.0	59.7	63.7	2.02	0.83
19.900	2.00	4.0	59.7	63.7	2.01	0.83
20.000	2.00	4.0	59.6	63.7	2.01	0.83
20.100	2.00	4.0	59.6	63.6	2.01	0.83
20.200	2.00	4.0	59.6	63.6	2.01	0.83

20.300	2.00		4.0	59.6	63.6	2.01
0.83						
20.400	2.00		4.0	59.6	63.6	2.01
0.83						
20.500	2.00		4.0	59.5	63.6	2.01
0.83						
20.600	2.00		4.0	59.5	63.5	2.01
0.83						
20.700	2.00		4.0	59.5	63.5	2.01
0.83						
20.800	2.00		4.0	59.5	63.5	2.01
0.83						
20.900	2.00		4.0	59.5	63.5	2.01
0.83						
21.000	2.00		4.0	59.5	63.5	2.00
0.83						
21.100	2.00		4.0	59.5	63.5	2.00
0.83						
21.200	2.00		4.0	59.5	63.5	2.00
0.83						
21.300	2.00		4.0	59.5	63.5	2.00
0.83						
21.400	2.00		4.0	59.5	63.5	2.00
0.83						
21.500	2.00		4.0	59.4	63.5	2.00
0.83						
21.600	2.00		4.0	59.4	63.4	2.00
0.83						
21.700	2.00		4.0	59.4	63.4	2.00
0.83						
21.800	2.00		4.0	59.4	63.4	2.00
0.83						
21.900	2.00		4.0	59.4	63.4	2.00
0.83						
22.000	2.00		4.0	59.4	63.4	2.00
0.83						
22.100	1.00		3.0	58.5	62.4	1.95
0.81						
22.200	1.00		2.0	56.8	60.5	1.86
0.79						
22.300	1.00		2.0	55.3	58.8	1.77
0.77						
22.400	1.00		2.0	53.9	57.3	1.69
0.75						
22.500	1.00		2.0	52.6	55.9	1.64
0.73						
22.600	1.00		2.0	51.4	54.6	1.58
0.71						

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD

INFLOW HYDROGRAPH ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
22.700	1.00	2.0	50.4	53.4	1.54	0.70
22.800	1.00	2.0	49.4	52.4	1.49	0.69
22.900	1.00	2.0	48.5	51.4	1.45	0.67
23.000	1.00	2.0	47.7	50.5	1.41	0.66
23.100	1.00	2.0	46.9	49.7	1.38	0.65
23.200	1.00	2.0	46.2	48.9	1.35	0.64
23.300	1.00	2.0	45.6	48.2	1.32	0.63
23.400	1.00	2.0	45.0	47.6	1.29	0.62
23.500	1.00	2.0	44.4	47.0	1.27	0.62
23.600	1.00	2.0	43.9	46.4	1.25	0.61
23.700	1.00	2.0	43.5	45.9	1.23	0.60
23.800	1.00	2.0	43.1	45.5	1.21	0.60
23.900	1.00	2.0	42.7	45.1	1.19	0.59

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD

Starting Pond W.S. Elevation = 0.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 34.00 cfs
Peak Outflow = 7.60 cfs
Peak Elevation = 3.50 ft

***** Summary of Approximate Peak Storage *****

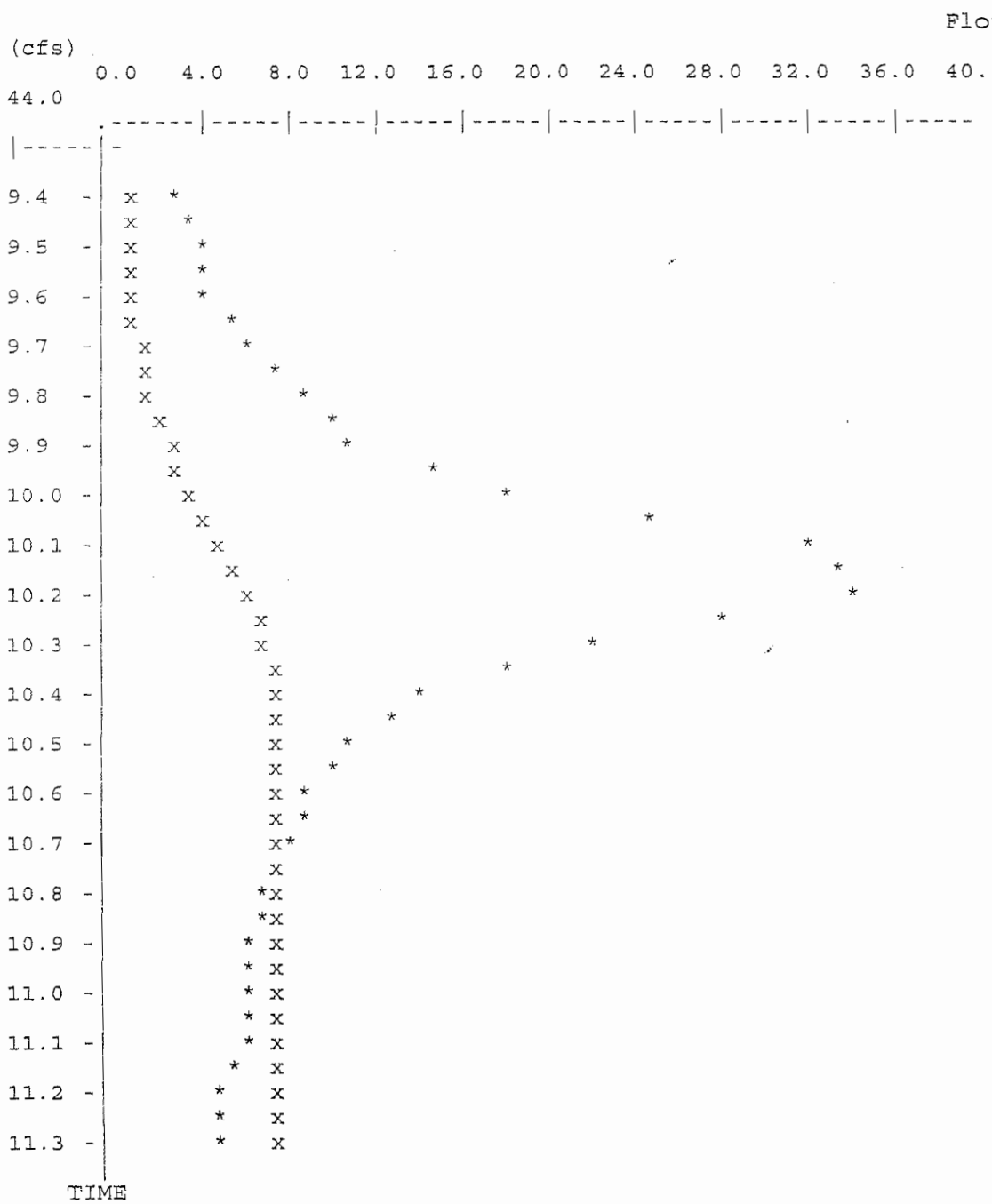
Initial Storage = 0.00 ac-ft
Peak Storage From Storm = 1.12 ac-ft

Total Storage in Pond = 1.12 ac-ft

Warning: Inflow hydrograph truncated on left side.
Warning: Inflow hydrograph truncated on right side.

Pond File: c:/temp/matt/9809\PROJ9809.PND
Inflow Hydrograph: c:/temp/matt/9809\HYDR9809.HYD
Outflow Hydrograph: c:/temp/matt/9809\OUT .HYD
EXECUTED: 04-01-2005 13:44:45

Peak Inflow = 34.00 cfs
Peak Outflow = 7.60 cfs
Peak Elevation = 3.50 ft



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(hrs)

*  File:  c:/temp/matt/9809\HYDR9809.HYD   Qmax =    34.0 cfs
x  File:  c:/temp/matt/9809\OUT     .HYD   Qmax =     7.6 cfs
```

Appendix E
Project Cost Estimate Details

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

North Fortuna Drainage: Main Street Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	859	859
		Insurance	1	LS	0.025	429	429
		Bonding	1	LS	0.025	429	429
		Contractor O&P	1	LS	0.150	2,576	2,576
		Sales Tax	1	LS	0.0725	1,245	1,245
Subtotal						5,537	5,537
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	84	CY	6.30	531	531
	02315 100 1900	Backfill	66	CY	7.40	488	488
	02315 100 2200	Compacting (Vibrating Roller)	29	CY	5.30	155	155
	02315 130 0050	Bedding (River Run)	55	TON	20.00	1,092	1,092
	02320 200 0200	Hauling/Disposal (Excess Excavation)	18	CY	10.60	194	194
02500	02530 730 3040	HDPE Piping (36" Laid in Trench)	70	LF	121.50	8,505	8,505
02700	02720 200 0300	Road Aggregate Base (12" River Run)	23	TON	30.00	693	693
	02740 300 0200	AC Pavement (4")	5	TON	90.00	457	457
	02766 550 0200	Pavement Markings (6")	35	LF	1.60	56	56
		Traffic Control	1	LS	5,000.00	5,000	5,000
Subtotal						17,170	17,170
Subtotal							$17,170
Division 010							$5,537
Construction Subtotal							$22,708
Cost per LF HDPE Installed							$324
20% Contingency							$4,542
25% Legal, Admin., Engineering							$5,677
Project Subtotal							$32,926
20% Bonding							$6,585
New Subtotal							$39,511
Opinion of Probable Cost per LF HDPE							**$564**
Engineers Opinion of Probable Construction Cost						CALL	**$40,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: U.S. Highway 101 Project

Winzler & Kelly Consulting Engineers

Prepared By: MGK

Date Prepared: 15-Jul-05

W&K Proj. No. 04-105402-011

ENR: June 2005 7,415

Escalated to ENR

Estimate Type: [X] Conceptual

[ ] Preliminary (w/o plans)

[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,322	1,322
		Insurance	1	LS	0.025	661	661
		Bonding	1	LS	0.025	661	661
		Contractor O&P	1	LS	0.150	3,966	3,966
		Sales Tax	1	LS	0.0725	1,917	1,917
Subtotal						8,527	8,527
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	289	CY	6.30	1,820	1,820
	02315 100 1900	Backfill	201	CY	7.40	1,484	1,484
	02315 100 2200	Compacting (Vibrating Roller)	81	CY	5.30	431	431
	02315 130 0050	Bedding (River Run)	177	TON	20.00	3,543	3,543
	02320 200 0200	Hauling/Disposal (Excess Excavation)	88	CY	10.60	937	937
02500	02530 730 0040	HDPE Piping (54" Laid in Trench)	150	LF	121.50	18,225	18,225
Subtotal						26,439	26,439
Subtotal							$25,439
Division 010							$8,527
Construction Subtotal							$34,965
Cost per LF HDPE installed							$233
20% Contingency							$5,993
25% Legal, Admin., Engineering							$8,741
Project Subtotal							$50,700
20% Bonding							$10,140
New Subtotal							$60,840
Opinion of Probable Cost per LF HDPE							**$406**
Engineers Opinion of Probable Construction Cost						CALL	**$61,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

North Fortuna Drainage: Quail Hollow Project (City Project No. 9813)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	640	640
		Insurance	1	LS	0.025	320	320
		Bonding	1	LS	0.025	320	320
		Contractor O&P	1	LS	0.150	1,920	1,920
		Sales Tax	1	LS	0.0725	928	928
Subtotal						4,128	4,128
		Earth/Site Work					
		Channel Excavation	500	CY	0.00	0	0
		Laborer (4)	107	HR	45.00	4,800	4,800
		Foreman (1)	27	HR	60.00	1,600	1,600
		Operator/Driver (2)	53	HR	50.00	2,667	2,667
		Back Hoe Rental (1)	27	HR	70.00	1,867	1,867
		Dump Truck Rental (1)	27	HR	70.00	1,867	1,867
Subtotal						12,800	12,800

Subtotal	$12,800
Division 010	$4,128
Construction Subtotal	$16,928
Cost per linear foot of channel	$38
20% Contingency	$3,386
25% Legal, Admin., Engineering	$4,232
Project Subtotal	$24,546
20% Bonding	$4,909
New Subtotal	$29,455
Opinion of Probable Cost per Linear Foot of Channel	**$67**
Engineers Opinion of Probable Construction Cost	**CALL** **$30,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: 3rd Street and Main Street Project
(City Project No. 9702)

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,025	2,025
		Insurance	1	LS	0.025	1,012	1,012
		Bonding	1	LS	0.025	1,012	1,012
		Contractor O&P	1	LS	0.150	6,075	6,075
		Sales Tax	1	LS	0.0725	2,936	2,936
Subtotal						13,061	13,061
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	347	CY	6.30	2,184	2,184
	02315 100 1900	Backfill	326	CY	7.40	2,410	2,410
	02315 100 2200	Compacting (Vibrating Roller)	183	CY	5.30	968	968
	02315 130 0050	Bedding (River Run)	213	TON	20.00	4,251	4,251
	02320 200 0200	Hauling/Disposal (Excess Excavation)	21	CY	10.60	222	222
02500	02530 730 2040	HDPE Piping (54" Laid in Trench)	180	LF	121.50	21,870	21,870
02700	02720 200 0300	Road Aggregate Base (12" River Run)	69	TON	30.00	2,079	2,079
	02740 300 0200	AC Pavement (4")	15	TON	90.00	1,370	1,370
	02766 550 0200	Pavement Markings (6")	90	LF	1.60	144	144
		Traffic Control	1	LS	5,000.00	5,000	5,000
Subtotal						40,498	40,498
Subtotal							$40,498
Division 010							$13,061
Construction Subtotal							$53,559
Cost per LF HDPE Installed							$298
20% Contingency							$10,712
25% Legal, Admin., Engineering							$13,390
Project Subtotal							$77,661
20% Bonding							$15,532
New Subtotal							$93,193
Opinion of Probable Cost per LF HDPE							**$518**
Engineers Opinion of Probable Construction Cost						CALL	**$93,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: South 6th Street Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,594	3,594
		Insurance	1	LS	0.025	1,797	1,797
		Bonding	1	LS	0.025	1,797	1,797
		Contractor O&P	1	LS	0.150	10,782	10,782
		Sales Tax	1	LS	0.0725	5,211	5,211
Subtotal						23,180	23,180
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	782	CY	6.30	4,928	4,928
	02315 100 1900	Backfill	680	CY	7.40	5,031	5,031
	02315 100 2200	Compacting (Vibrating Roller)	359	CY	5.30	1,900	1,900
	02315 130 0050	Bedding (River Run)	477	TON	20.00	9,543	9,543
	02320 200 0200	Hauling/Disposal (Excess Excavation)	102	CY	10.60	1,085	1,085
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	880	LF	37.00	32,560	32,560
02700	02720 200 0300	Road Aggregate Base (12" River Run)	242	TON	30.00	7,260	7,260
	02740 300 0200	AC Pavement (4")	106	TON	90.00	9,570	9,570
Subtotal						71,877	71,877
Subtotal							$71,877
Division 010							$23,180
Construction Subtotal							$95,058
Cost per LF HDPE Installed							$108
20% Contingency							$19,012
25% Legal, Admin., Engineering							$23,764
Project Subtotal							$137,833
20% Bonding							$27,567
New Subtotal							$165,400
Opinion of Probable Cost per LF HDPE							**$188**
Engineers Opinion of Probable Construction Cost						CALL	**$165,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: Main Street Project No. 2

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 15-Jul-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	8,389	8,389
		Insurance	1	LS	0.025	4,194	4,194
		Bonding	1	LS	0.025	4,194	4,194
		Contractor O&P	1	LS	0.150	25,166	25,166
		Sales Tax	1	LS	0.0725	12,163	12,163
Subtotal						54,106	54,106
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,541	CY	6.30	9,707	9,707
	02315 100 1900	Backfill	1,448	CY	7.40	10,713	10,713
	02315 100 2200	Compacting (Vibrating Roller)	811	CY	5.30	4,301	4,301
	02315 130 0050	Bedding (River Run)	945	TON	20.00	18,894	18,894
	02320 200 0200	Hauling/Disposal (Excess Excavation)	93	CY	10.60	987	987
02500	02530 730 2040	HDPE Piping (54" Laid in Trench)	800	LF	121.50	97,200	97,200
02700	02720 200 0300	Road Aggregate Base (12" River Run)	308	TON	30.00	9,240	9,240
	02740 300 0200	AC Pavement (4")	68	TON	90.00	6,090	6,090
	02766 550 0200	Pavement Markings (6")	400	LF	1.60	640	640
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						167,771	167,771
Subtotal							$167,771
Division 010							$54,106
Construction Subtotal							$221,877
Cost per LF HDPE Installed							$277
20% Contingency							$44,375
25% Legal, Admin., Engineering							$55,469
Project Subtotal							$321,722
20% Bonding							$64,344
New Subtotal							$386,066
Opinion of Probable Cost per LF HDPE							**$483**
Engineers Opinion of Probable Construction Cost						CALL	**$387,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: Home Avenue Project (City Project No. 9801)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,088	7,088
		Insurance	1	LS	0.025	3,544	3,544
		Bonding	1	LS	0.025	3,544	3,544
		Contractor O&P	1	LS	0.150	21,264	21,264
		Sales Tax	1	LS	0.0725	10,278	10,278
Subtotal						45,718	45,718
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,182	CY	6.30	7,448	7,448
	02315 100 1900	Backfill	1,027	CY	7.40	7,603	7,603
	02315 100 2200	Compacting (Vibrating Roller)	542	CY	5.30	2,872	2,872
	02315 130 0050	Bedding (River Run)	721	TON	20.00	14,423	14,423
	02320 200 0200	Hauling/Disposal (Excess Excavation)	155	CY	10.60	1,640	1,640
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	1,330	LF	37.00	49,210	49,210
02700	02720 200 0300	Road Aggregate Base (12" River Run)	366	TON	30.00	10,973	10,973
	02740 300 0200	AC Pavement (4")	161	TON	90.00	14,464	14,464
	02766 550 0200	Pavement Markings (6")	1,330	LF	1.60	2,128	2,128
		Traffic Control	1	LS	10,000.00	10,000	10,000
		New Manhole	3	EA	5,000.00	15,000	15,000
		New Drop Inlet	2	EA	3,000.00	6,000	6,000
Subtotal						141,761	141,761

Subtotal	$141,761
Division 010	$45,718
Construction Subtotal	$187,478
Cost per LF HDPE Installed	$141
20% Contingency	$37,496
25% Legal, Admin., Engineering	$46,870
Project Subtotal	$271,844
20% Bonding	$54,369
New Subtotal	$326,212
Opinion of Probable Cost per LF HDPE	**$245**
Engineers Opinion of Probable Construction Cost	**CALL** **$326,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

North Fortuna Drainage: 11th Street and N Street Project
(City Project No. 9504)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,201	7,201
		Insurance	1	LS	0.025	3,601	3,601
		Bonding	1	LS	0.025	3,601	3,601
		Contractor O&P	1	LS	0.150	21,604	21,604
		Sales Tax	1	LS	0.0725	10,442	10,442
Subtotal						46,448	46,448
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,129	CY	6.30	7,112	7,112
	02315 100 1900	Backfill	953	CY	7.40	7,049	7,049
	02315 100 2200	Compacting (Vibrating Roller)	471	CY	5.30	2,495	2,495
	02315 130 0050	Bedding (River Run)	716	TON	20.00	14,312	14,312
	02320 200 0200	Hauling/Disposal (Excess Excavation)	176	CY	10.60	1,869	1,869
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	640	LF	37.00	23,680	23,680
	02530 730 2050	HDPE Piping (30" Laid in Trench)	560	LF	52.80	29,568	29,568
02700	02720 200 0300	Road Aggregate Base (12" River Run)	345	TON	30.00	10,362	10,362
	02740 300 0200	AC Pavement (4")	152	TON	90.00	13,659	13,659
	02766 550 0200	Pavement Markings (6")	1,200	LF	1.60	1,920	1,920
		New Manholes (48")	2	EA	5,000.00	10,000	10,000
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						144,025	144,025

Subtotal	$144,025
Division 010	$46,448
Construction Subtotal	$190,473
Cost per LF HDPE Installed	$159
20% Contingency	$38,095
25% Legal, Admin., Engineering	$47,618
Project Subtotal	$276,187
20% Bonding	$55,237
New Subtotal	$331,424
Opinion of Probable Cost per LF HDPE	**$276**
Engineers Opinion of Probable Construction Cost	**CALL** **$331,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: 9th Street Project No. 1 (City Project No. 9506)

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 22-Jun-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,831	3,831
		Insurance	1	LS	0.025	1,916	1,916
		Bonding	1	LS	0.025	1,916	1,916
		Contractor O&P	1	LS	0.150	11,494	11,494
		Sales Tax	1	LS	0.0725	5,555	5,555
Subtotal						24,712	24,712
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	578	CY	6.30	3,640	3,640
	02315 100 1900	Backfill	452	CY	7.40	3,346	3,346
	02315 100 2200	Compacting (Vibrating Roller)	200	CY	5.30	1,060	1,060
	02315 130 0050	Bedding (River Run)	374	TON	20.00	7,488	7,488
	02320 200 0200	Hauling/Disposal (Excess Excavation)	126	CY	10.60	1,332	1,332
02500	02530 730 2030	HDPE Piping (36" Laid in Trench)	480	LF	68.70	32,976	32,976
02700	02720 200 0300	Road Aggregate Base (12" River Run)	158	TON	30.00	4,752	4,752
	02740 300 0200	AC Pavement (4")	70	TON	90.00	6,264	6,264
	02766 550 0200	Pavement Markings (6")	480	LF	1.60	768	768
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						76,625	76,625

Subtotal	$76,625
Division 010	$24,712
Construction Subtotal	$101,337
Cost per LF HDPE Installed	$211
20% Contingency	$20,267
25% Legal, Admin., Engineering	$25,334
Project Subtotal	$146,939
20% Bonding	$29,388
New Subtotal	$176,327
Opinion of Probable Cost per LF HDPE	**$367**
Engineers Opinion of Probable Construction Cost CALL	**$176,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

North Fortuna Drainage: 9th Street Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	10,623	10,623
		Insurance	1	LS	0.025	5,312	5,312
		Bonding	1	LS	0.025	5,312	5,312
		Contractor O&P	1	LS	0.150	31,870	31,870
		Sales Tax	1	LS	0.0725	15,404	15,404
Subtotal						68,521	68,521
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,100	CY	6.30	6,930	6,930
	02315 100 1900	Backfill	900	CY	7.40	6,660	6,660
	02315 100 2200	Compacting (Vibrating Roller)	413	CY	5.30	2,186	2,186
	02315 130 0050	Bedding (River Run)	724	TON	20.00	14,479	14,479
	02320 200 0200	Hauling/Disposal (Excess Excavation)	200	CY	10.60	2,120	2,120
02500	02530 730 2040	HDPE Piping (30" Laid in Trench)	1,100	LF	121.50	133,650	133,650
02700	02720 200 0300	Road Aggregate Base (12" River Run)	333	TON	30.00	9,983	9,983
	02740 300 0200	AC Pavement (4")	73	TON	90.00	6,579	6,579
	02766 550 0200	Pavement Markings (6")	550	LF	1.60	880	880
		New Drop Inlet	3	EA	3,000.00	9,000	9,000
		New Manhole (48")	3	EA	5,000.00	15,000	15,000
		Traffic Control	1	LS	5,000.00	5,000	5,000
Subtotal						212,467	212,467

Subtotal	$212,467
Division 010	$68,521
Construction Subtotal	$280,988
Cost per LF HDPE Installed	$255
20% Contingency	$56,198
25% Legal, Admin., Engineering	$70,247
Project Subtotal	$407,433
20% Bonding	$81,487
New Subtotal	$488,919
Opinion of Probable Cost per LF HDPE	**$444**
Engineers Opinion of Probable Construction Cost	**CALL** **$489,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: 10th Street Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	8,469	8,469
		Insurance	1	LS	0.025	4,235	4,235
		Bonding	1	LS	0.025	4,235	4,235
		Contractor O&P	1	LS	0.150	25,408	25,408
		Sales Tax	1	LS	0.0725	12,281	12,281
Subtotal						54,628	54,628
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,000	CY	6.30	6,300	6,300
	02315 100 1900	Backfill	818	CY	7.40	6,055	6,055
	02315 100 2200	Compacting (Vibrating Roller)	375	CY	5.30	1,988	1,988
	02315 130 0050	Bedding (River Run)	658	TON	20.00	13,163	13,163
	02320 200 0200	Hauling/Disposal (Excess Excavation)	182	CY	10.60	1,927	1,927
02500	02530 730 2040	HDPE Piping (30" Laid in Trench)	1,000	LF	121.50	121,500	121,500
02700	02720 200 0300	Road Aggregate Base (12" River Run)	303	TON	30.00	9,075	9,075
	02740 300 0200	AC Pavement (4")	66	TON	90.00	5,981	5,981
	02766 550 0200	Pavement Markings (6")	250	LF	1.60	400	400
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						169,388	169,388
Subtotal							$169,388
Division 010							$54,628
Construction Subtotal							$224,016
Cost per LF HDPE Installed							$224
20% Contingency							$44,803
25% Legal, Admin., Engineering							$56,004
Project Subtotal							$324,823
20% Bonding							$64,965
New Subtotal							$389,788
Opinion of Probable Cost per LF HDPE							$390
Engineers Opinion of Probable Construction Cost						CALL	$390,000

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Spring Street Project (City Project No. 9810)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	6,587	6,587
		Insurance	1	LS	0.025	3,294	3,294
		Bonding	1	LS	0.025	3,294	3,294
		Contractor O&P	1	LS	0.150	19,762	19,762
		Sales Tax	1	LS	0.050	6,587	6,587
Subtotal						39,524	39,524
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,122	CY	6.30	7,070	7,070
	02315 100 1900	Backfill	1,008	CY	7.40	7,460	7,460
	02315 100 2200	Compacting (Vibrating Roller)	573	CY	5.30	3,035	3,035
	02315 130 0050	Bedding (River Run)	647	TON	20.00	12,930	12,930
	02320 200 0200	Hauling/Disposal (Excess Excavation)	114	CY	10.60	1,210	1,210
02500	02530 730 2030	HDPE Piping (18" Laid in Trench)	900	LF	26.40	23,760	23,760
	02530 730 2040	HDPE Piping (24" Laid in Trench)	475	LF	37.00	17,575	17,575
02700	02720 200 0300	Road Aggregate Base (12" River Run)	278	TON	30.00	8,333	8,333
	02740 300 0200	AC Pavement (4")	155	TON	90.00	13,974	13,974
	02766 550 0200	Pavement Markings (6")	2,750	LF	1.60	4,400	4,400
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
		New Manhole	2	EA	5,000.00	10,000	10,000
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						131,747	131,747

Subtotal	$131,747
Division 010	$39,524
Construction Subtotal	$171,271
Cost per LF HDPE Installed	$125
20% Contingency	$34,254
25% Legal, Admin., Engineering	$42,818
Project Subtotal	$248,343
20% Bonding	$49,669
New Subtotal	$298,012
Opinion of Probable Cost per LF HDPE	**$217**
Engineers Opinion of Probable Construction Cost CALL	**$298,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Newburg Drive Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	8,352	8,352
		Insurance	1	LS	0.025	4,176	4,176
		Bonding	1	LS	0.025	4,176	4,176
		Contractor O&P	1	LS	0.150	25,055	25,055
		Sales Tax	1	LS	0.0725	12,110	12,110
Subtotal						53,867	53,867
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	2,187	CY	6.30	13,780	13,780
	02315 100 1900	Backfill	1,646	CY	7.40	12,180	12,180
	02315 100 2200	Compacting (Vibrating Roller)	1,092	CY	5.30	5,790	5,790
	02315 130 0050	Bedding (River Run)	822	TON	20.00	16,440	16,440
	02320 200 0200	Hauling/Disposal (Excess Excavation)	541	CY	10.60	5,738	5,738
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	1,420	LF	37.00	52,540	52,540
	02530 730 2050	HDPE Piping (36" Laid in Trench)	135	LF	52.80	7,128	7,128
02700	02720 200 0300	Road Aggregate Base (12" River Run)	517	TON	30.00	15,506	15,506
	02740 300 0200	AC Pavement (4")	227	TON	90.00	20,440	20,440
	02766 550 0200	Pavement Markings (6")	1,555	LF	1.60	2,488	2,488
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						167,030	167,030

Subtotal	$167,030
Division 010	$53,867
Construction Subtotal	$220,897
Cost per LF HDPE Installed	$142
20% Contingency	$44,179
25% Legal, Admin., Engineering	$55,224
Project Subtotal	$320,301
20% Bonding	$64,060
New Subtotal	$384,361
Opinion of Probable Cost per LF HDPE	**$247**
Engineers Opinion of Probable Construction Cost	**CALL** **$384,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Rohner Creek Drainage: Fortuna Boulevard Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	8,040	8,040
		Insurance	1	LS	0.025	4,020	4,020
		Bonding	1	LS	0.025	4,020	4,020
		Contractor O&P	1	LS	0.150	24,121	24,121
		Sales Tax	1	LS	0.0725	11,659	11,659
Subtotal						51,861	51,861
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,521	CY	6.30	9,584	9,584
	02315 100 1900	Backfill	1,206	CY	7.40	8,928	8,928
	02315 100 2200	Compacting (Vibrating Roller)	641	CY	5.30	3,397	3,397
	02315 130 0050	Bedding (River Run)	840	TON	20.00	16,798	16,798
	02320 200 0200	Hauling/Disposal (Excess Excavation)	315	CY	10.60	3,337	3,337
02500	02530 730 2040	HDPE Piping (30" Laid in Trench)	450	LF	37.00	16,650	16,650
	02530 730 2050	HDPE Piping (36" Laid in Trench)	890	LF	52.80	46,992	46,992
02700	02720 200 0300	Road Aggregate Base (12" River Run)	418	TON	30.00	12,532	12,532
	02740 300 0200	AC Pavement (4")	184	TON	90.00	16,519	16,519
	02766 550 0200	Pavement Markings (6")	670	LF	1.60	1,072	1,072
		New Manhole	2	EA	5,000.00	10,000	10,000
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						160,809	160,809

Subtotal	$160,809
Division 010	$51,861
Construction Subtotal	$212,670
Cost per LF HDPE Installed	$159
20% Contingency	$42,534
25% Legal, Admin., Engineering	$53,168
Project Subtotal	$308,372
20% Bonding	$61,674
New Subtotal	$370,046
Opinion of Probable Cost per LF HDPE	**$276**
Engineers Opinion of Probable Construction Cost CALL	**$370,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Rohner Creek Widening Project
(City Project No. 9600)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,020	7,020
		Insurance	1	LS	0.025	3,510	3,510
		Bonding	1	LS	0.025	3,510	3,510
		Contractor O&P	1	LS	0.150	21,060	21,060
		Sales Tax	1	LS	0.0725	10,179	10,179
Subtotal						45,279	45,279
02300		**Earth/Site Work**					
		Channel Excavation	9,000	CY	0.00	0	0
		Laborer (2)	720	HR	45.00	32,400	32,400
		Foreman (1)	360	HR	60.00	21,600	21,600
		Operator/Driver (2)	720	HR	50.00	36,000	36,000
02500		Back Hoe Rental (1)	360	HR	70.00	25,200	25,200
		Dump Truck Rental (1)	360	HR	70.00	25,200	25,200
Subtotal						140,400	140,400

Subtotal	$140,400
Division 010	$45,279
Construction Subtotal	$185,679
Cost per LF HDPE installed	$258
20% Contingency	$37,136
25% Legal, Admin., Engineering	$46,420
Project Subtotal	$269,235
20% Bonding	$53,847
New Subtotal	$323,081
Opinion of Probable Cost per LF HDPE	**$449**
Engineers Opinion of Probable Construction Cost CALL	**$323,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Rohner Creek Drainage: Rohner Creek Bypass Project
(City Project No. 9601 & City Project No. 9704)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	64,429	64,429
		Insurance	1	LS	0.025	32,214	32,214
		Bonding	1	LS	0.025	32,214	32,214
		Contractor O&P	1	LS	0.150	193,287	193,287
		Sales Tax	1	LS	0.0725	93,422	93,422
Subtotal						415,567	415,567
		Earth/Site Work					
		Channel Excavation	12,000	CY	0.00	0	0
		Rock Slope Protection (Placed)	9,528	CY	100.00	952,750	952,750
		Laborer (2)	1,722	HR	45.00	77,499	77,499
		Foreman (1)	861	HR	60.00	51,666	51,666
		Operator/Driver (2)	1,722	HR	50.00	86,110	86,110
		Back Hoe Rental (1)	861	HR	70.00	60,277	60,277
		Dump Truck Rental (1)	861	HR	70.00	60,277	60,277
Subtotal						1,288,579	1,288,579

Subtotal	$1,288,579
Division 010	$415,567
Construction Subtotal	$1,704,146
Cost per linear foot of channel	$757
20% Contingency	$340,829
25% Legal, Admin., Engineering	$426,036
Project Subtotal	$2,471,011
20% Bonding	$494,202
New Subtotal	$2,965,214
Opinion of Probable Cost per Linear Foot of Channel	**$1,318**
Engineers Opinion of Probable Construction Cost	**CALL** **$2,926,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Rohner Creek Bypass Project
(City Project No. 9601 & City Project No. 9704)

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,520	7,520
		Insurance	1	LS	0.025	3,760	3,760
		Bonding	1	LS	0.025	3,760	3,760
		Contractor O&P	1	LS	0.150	22,560	22,560
		Sales Tax	1	LS	0.0725	10,904	10,904
Subtotal						48,504	48,504
		Earth/Site Work					
		Detention Basin Excavation	9,000	CY	0.00	0	0
		Laborer (2)	720	HR	45.00	32,400	32,400
		Foreman (1)	360	HR	60.00	21,600	21,600
		Operator/Driver (2)	720	HR	50.00	36,000	36,000
		Back Hoe Rental (1)	360	HR	70.00	25,200	25,200
		Dump Truck Rental (1)	360	HR	70.00	25,200	25,200
		Inlet/Outlet Structure	1	LS	10,000.00	10,000	10,000
Subtotal						150,400	150,400
Subtotal							$150,400
Division 010							$48,504
Construction Subtotal							$198,904
Cost per cubic yard of basin							$22
20% Contingency							$39,781
25% Legal, Admin., Engineering							$49,726
Project Subtotal							$288,411
20% Bonding							$57,682
New Subtotal							$346,093
Opinion of Probable Cost per Cubic Yard of Basin							**$38**
Engineers Opinion of Probable Construction Cost						**CALL**	**$346,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Rohner Creek Drainage: South 15th Street Project

Winzler & Kelly Consulting Engineers
Prepared By: MGK
Date Prepared: 18-Jul-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,270	4,270
		Insurance	1	LS	0.025	2,135	2,135
		Bonding	1	LS	0.025	2,135	2,135
		Contractor O&P	1	LS	0.150	12,810	12,810
		Sales Tax	1	LS	0.0725	6,191	6,191
Subtotal						27,541	27,541
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,213	CY	6.30	7,639	7,639
	02315 100 1900	Backfill	941	CY	7.40	6,961	6,961
	02315 100 2200	Compacting (Vibrating Roller)	523	CY	5.30	2,770	2,770
	02315 130 0050	Bedding (River Run)	621	TON	20.00	12,415	12,415
	02320 200 0200	Hauling/Disposal (Excess Excavation)	272	CY	10.60	2,881	2,881
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	175	LF	37.00	6,475	6,475
	02530 730 2050	HDPE Piping (36" Laid in Trench)	800	LF	52.80	42,240	42,240
02700	02720 200 0300	Road Aggregate Base (12" River Run)	58	TON	30.00	1,733	1,733
	02740 300 0200	AC Pavement (4")	25	TON	90.00	2,284	2,284
Subtotal						85,398	85,398

Subtotal	$85,398
Division 010	$27,541
Construction Subtotal	$112,938
Cost per LF HDPE Installed	$116
20% Contingency	$22,588
25% Legal, Admin., Engineering	$28,235
Project Subtotal	$163,761
20% Bonding	$32,752
New Subtotal	$196,513
Opinion of Probable Cost per LF HDPE	**$202**
Engineers Opinion of Probable Construction Cost CALL	**$197,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Carson Woods Road Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,043	2,043
		Insurance	1	LS	0.025	1,022	1,022
		Bonding	1	LS	0.025	1,022	1,022
		Contractor O&P	1	LS	0.150	6,129	6,129
		Sales Tax	1	LS	0.0725	2,962	2,962
Subtotal						13,177	13,177
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	713	CY	6.30	4,492	4,492
	02315 100 1900	Backfill	535	CY	7.40	3,957	3,957
	02315 100 2200	Compacting (Vibrating Roller)	361	CY	5.30	1,914	1,914
	02315 130 0050	Bedding (River Run)	258	TON	20.00	5,158	5,158
	02320 200 0200	Hauling/Disposal (Excess Excavation)	178	CY	10.60	1,889	1,889
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	500	LF	37.00	18,500	18,500
02700	02720 200 0300	Road Aggregate Base (12" River Run)	165	TON	30.00	4,950	4,950
Subtotal						40,860	40,860

Subtotal	$40,860
Division 010	$13,177
Construction Subtotal	$54,037
Cost per LF HDPE Installed	$108
20% Contingency	$10,807
25% Legal, Admin., Engineering	$13,509
Project Subtotal	$78,354
20% Bonding	$15,671
New Subtotal	$94,025
Opinion of Probable Cost per LF HDPE	**$188**
Engineers Opinion of Probable Construction Cost CALL	**$94,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Rohner Creek Drainage: Carson Woods Road Project (Alternative)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,770	1,770
		Insurance	1	LS	0.025	885	885
		Bonding	1	LS	0.025	885	885
		Contractor O&P	1	LS	0.150	5,310	5,310
		Sales Tax	1	LS	0.0725	2,567	2,567
Subtotal						11,417	11,417
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	444	CY	6.30	2,800	2,800
	02315 100 1900	Backfill	386	CY	7.40	2,858	2,858
	02315 100 2200	Compacting (Vibrating Roller)	204	CY	5.30	1,080	1,080
	02315 130 0050	Bedding (River Run)	271	TON	20.00	5,422	5,422
	02320 200 0200	Hauling/Disposal (Excess Excavation)	58	CY	10.60	617	617
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	500	LF	37.00	18,500	18,500
02700	02720 200 0300	Road Aggregate Base (12" River Run)	138	TON	30.00	4,125	4,125
Subtotal						35,402	35,402

Subtotal	$35,402
Division 010	$11,417
Construction Subtotal	$46,819
Cost per LF HDPE Installed	$94
20% Contingency	$9,364
25% Legal, Admin., Engineering	$11,705
Project Subtotal	$67,887
20% Bonding	$13,577
New Subtotal	$81,465
Opinion of Probable Cost per LF HDPE	**$163**
Engineers Opinion of Probable Construction Cost	**CALL** **$82,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Hillside Creek Drainage: Hillside Creek Outflow Project

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 22-Jun-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,819	1,819
		Insurance	1	LS	0.025	910	910
		Bonding	1	LS	0.025	910	910
		Contractor O&P	1	LS	0.150	5,457	5,457
		Sales Tax	1	LS	0.0725	2,638	2,638
Subtotal						11,733	11,733
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	313	CY	6.30	1,972	1,972
	02315 100 1900	Backfill	245	CY	7.40	1,812	1,812
	02315 100 2200	Compacting (Vibrating Roller)	108	CY	5.30	574	574
	02315 130 0050	Bedding (River Run)	203	TON	20.00	4,056	4,056
	02320 200 0200	Hauling/Disposal (Excess Excavation)	68	CY	10.60	722	722
02500	02530 730 2080	HDPE Piping (36" Laid in Trench)	260	LF	68.70	17,862	17,862
02700	02720 200 0300	Road Aggregate Base (12" River Run)	86	TON	30.00	2,574	2,574
	02740 300 0200	AC Pavement (4")	38	TON	90.00	3,393	3,393
	02766 550 0200	Pavement Markings (6")	260	LF	1.60	416	416
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						36,380	36,380
Subtotal							$36,380
Division 010							$11,733
Construction Subtotal							$48,113
Cost per LF HDPE Installed							$185
20% Contingency							$9,623
25% Legal, Admin., Engineering							$12,028
Project Subtotal							$69,764
20% Bonding							$13,953
New Subtotal							$83,717
Opinion of Probable Cost per LF HDPE							**$322**
Engineers Opinion of Probable Construction Cost						CALL	**$84,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Hillside Creek Drainage: Fortuna Boulevard Project No. 2

Winzler & Kelly Consulting Engineers
Prepared By: MGK
Date Prepared: 18-Jul-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,981	7,981
		Insurance	1	LS	0.025	3,991	3,991
		Bonding	1	LS	0.025	3,991	3,991
		Contractor O&P	1	LS	0.150	23,944	23,944
		Sales Tax	1	LS	0.0725	11,573	11,573
Subtotal						51,479	51,479
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,276	CY	6.30	8,036	8,036
	02315 100 1900	Backfill	1,109	CY	7.40	8,204	8,204
	02315 100 2200	Compacting (Vibrating Roller)	585	CY	5.30	3,099	3,099
	02315 130 0050	Bedding (River Run)	778	TON	20.00	15,561	15,561
	02320 200 0200	Hauling/Disposal (Excess Excavation)	167	CY	10.60	1,770	1,770
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	1,435	LF	37.00	53,095	53,095
02700	02720 200 0300	Road Aggregate Base (12" River Run)	395	TON	30.00	11,839	11,839
	02740 300 0200	AC Pavement (4")	208	TON	90.00	18,727	18,727
	02756 550 0200	Pavement Markings (6")	1,435	LF	1.60	2,296	2,296
		Traffic Control	1	LS	10,000.00	10,000	10,000
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
		New Manhole	3	EA	5,000.00	15,000	15,000
Subtotal						159,626	159,626

Subtotal	$159,626
Division 010	$51,479
Construction Subtotal	$211,105
Cost per LF HDPE Installed	$147
20% Contingency	$42,221
25% Legal, Admin., Engineering	$52,776
Project Subtotal	$306,103
20% Bonding	$61,221
New Subtotal	$367,323
Opinion of Probable Cost per LF HDPE	**$256**
Engineers Opinion of Probable Construction Cost	**CALL** **$367,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Hillside Creek Drainage: Stockton Property Detention Basin Project
(City Project No. 9701)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	13,800	13,800
		Insurance	1	LS	0.025	6,900	6,900
		Bonding	1	LS	0.025	6,900	6,900
		Contractor O&P	1	LS	0.150	41,400	41,400
		Sales Tax	1	LS	0.0725	20,010	20,010
Subtotal						89,010	89,010
02300		**Earth/Site Work**					
		Detention Basin Excavation	20,000	CY	0.00	0	0
		Laborer (1)	800	HR	45.00	36,000	36,000
		Foreman (1)	800	HR	60.00	48,000	48,000
		Operator/Driver (2)	1,600	HR	50.00	80,000	80,000
		Back Hoe Rental (1)	800	HR	70.00	56,000	56,000
		Dump Truck Rental (1)	800	HR	70.00	56,000	56,000
Subtotal						276,000	276,000
Subtotal							$276,000
Division 010							$89,010
Construction Subtotal							$365,010
Cost per cubic yard of basin							$18
20% Contingency							$73,002
25% Legal, Admin., Engineering							$91,253
Project Subtotal							$529,265
20% Bonding							$105,853
New Subtotal							$635,117
Opinion of Probable Cost per Cubic Yard of Basin							**$32**
Engineers Opinion of Probable Construction Cost						**CALL**	**$635,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Hillside Creek Drainage: Rohnerville Road Project No. 1

Winzler & Kelly Consulting Engineers
Prepared By: MGK
Date Prepared: 22-Jun-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	11,940	11,940
		Insurance	1	LS	0.025	5,970	5,970
		Bonding	1	LS	0.025	5,970	5,970
		Contractor O&P	1	LS	0.150	35,819	35,819
		Sales Tax	1	LS	0.0725	17,312	17,312
Subtotal						77,011	77,011
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,983	CY	6.30	12,495	12,495
	02315 100 1900	Backfill	1,329	CY	7.40	9,833	9,833
	02315 100 2200	Compacting (Vibrating Roller)	525	CY	5.30	2,783	2,783
	02315 130 0050	Bedding (River Run)	1,194	TON	20.00	23,874	23,874
	02320 200 0200	Hauling/Disposal (Excess Excavation)	654	CY	10.60	6,938	6,938
	02530 730 2060	HDPE Piping (60" Laid in Trench)	900	LF	132.10	118,890	118,890
02700	02720 200 0300	Road Aggregate Base (12" River Run)	396	TON	30.00	11,880	11,880
	02740 300 0200	AC Pavement (4")	174	TON	90.00	15,660	15,660
	02766 550 0200	Pavement Markings (6")	900	LF	1.60	1,440	1,440
		New Manholes (48")	1	EA	5,000.00	5,000	5,000
		Traffic Control	1	LS	30,000.00	30,000	30,000
Subtotal						238,792	238,792

Subtotal	$238,792
Division 010	$77,011
Construction Subtotal	$315,803
Cost per LF HDPE Installed	$351
20% Contingency	$63,161
25% Legal, Admin., Engineering	$78,951
Project Subtotal	$457,914
20% Bonding	$91,583
New Subtotal	$549,497
Opinion of Probable Cost per LF HDPE	**$611**
Engineers Opinion of Probable Construction Cost CALL	**$550,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Hillside Creek Drainage: Rohnerville Road Project No. 2

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	6,139	6,139
		Insurance	1	LS	0.025	3,070	3,070
		Bonding	1	LS	0.025	3,070	3,070
		Contractor O&P	1	LS	0.150	18,418	18,418
		Sales Tax	1	LS	0.050	6,139	6,139
Subtotal						36,836	36,836
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,201	CY	6.30	7,567	7,567
	02315 100 1900	Backfill	1,073	CY	7.40	7,937	7,937
	02315 100 2200	Compacting (Vibrating Roller)	602	CY	5.30	3,189	3,189
	02315 130 0050	Bedding (River Run)	699	TON	20.00	13,986	13,986
	02320 200 0200	Hauling/Disposal (Excess Excavation)	128	CY	10.60	1,362	1,362
02500	02530 730 2030	HDPE Piping (18" Laid in Trench)	790	LF	26.40	20,856	20,856
	02530 730 2040	HDPE Piping (24" Laid in Trench)	660	LF	37.00	24,420	24,420
02700	02720 200 0300	Road Aggregate Base (12" River Run)	297	TON	30.00	8,918	8,918
	02740 300 0200	AC Pavement (4")	166	TON	90.00	14,910	14,910
	02766 550 0200	Pavement Markings (6")	2,900	LF	1.60	4,640	4,640
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						122,785	122,785
Subtotal							$122,785
Division 010							$36,836
Construction Subtotal							$159,621
Cost per LF HDPE Installed							$110
20% Contingency							$31,924
25% Legal, Admin., Engineering							$39,905
Project Subtotal							$231,450
20% Bonding							$46,290
New Subtotal							$277,740
Opinion of Probable Cost per LF HDPE							**$192**
Engineers Opinion of Probable Construction Cost						**CALL**	**$278,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Hillside Creek Drainage: Newburg Drive Project No. 2

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,774	1,774
		Insurance	1	LS	0.025	887	887
		Bonding	1	LS	0.025	887	887
		Contractor O&P	1	LS	0.150	5,322	5,322
		Sales Tax	1	LS	0.050	1,774	1,774
Subtotal						10,644	10,644
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	187	CY	6.30	1,176	1,176
	02315 100 1900	Backfill	171	CY	7.40	1,265	1,265
	02315 100 2200	Compacting (Vibrating Roller)	101	CY	5.30	536	536
	02315 130 0050	Bedding (River Run)	104	TON	20.00	2,074	2,074
	02320 200 0200	Hauling/Disposal (Excess Excavation)	16	CY	10.60	167	167
02500	02530 730 2030	HDPE Piping (18" Laid in Trench)	240	LF	26.40	6,336	6,336
02700	02720 200 0300	Road Aggregate Base (12" River Run)	46	TON	30.00	1,386	1,386
	02740 300 0200	A/C Pavement (4")	26	TON	90.00	2,349	2,349
	02766 550 0200	Pavement Markings (6")	120	LF	1.60	192	192
		Traffic Control	1	LS	15,000.00	15,000	15,000
		New Manholes (48")	1	EA	5,000.00	5,000	5,000
Subtotal						35,481	35,481

Subtotal	$35,481
Division 010	$10,644
Construction Subtotal	$46,125
Cost per LF HDPE Installed	$192
20% Contingency	$9,225
25% Legal, Admin., Engineering	$11,531
Project Subtotal	$66,882
20% Bonding	$13,376
New Subtotal	$80,258
Opinion of Probable Cost per LF HDPE	**$334**
Engineers Opinion of Probable Construction Cost	**CALL** **$80,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Hillside Creek Drainage: Hillside Creek Culvert Replacement Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-1 05402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,105	1,105
		Insurance	1	LS	0.025	553	553
		Bonding	1	LS	0.025	553	553
		Contractor O&P	1	LS	0.150	3,316	3,316
		Sales Tax	1	LS	0.0725	1,603	1,603
Subtotal						7,130	7,130
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	107	CY	6.30	674	674
	02315 100 1900	Backfill	80	CY	7.40	594	594
	02315 100 2200	Compacting (Vibrating Roller)	54	CY	5.30	287	287
	02315 130 0050	Bedding (River Run)	39	TON	20.00	774	774
	02320 200 0200	Hauling/Disposal (Excess Excavation)	27	CY	10.60	283	283
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	75	LF	37.00	2,775	2,775
02700	02720 200 0300	Road Aggregate Base (12" River Run)	25	TON	30.00	743	743
	02740 300 0200	AC Pavement (4")	11	TON	90.00	979	979
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						22,108	22,108

Subtotal	$22,108
Division 010	$7,130
Construction Subtotal	$29,237
Cost per LF HDPE Installed	$390
20% Contingency	$5,847
25% Legal, Admin., Engineering	$7,309
Project Subtotal	$42,394
20% Bonding	$8,479
New Subtotal	$50,873
Opinion of Probable Cost per LF HDPE	**$678**
Engineers Opinion of Probable Construction Cost CALL	**$51,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Hillside Creek Drainage: Hillside Drive Detention Basin Project

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 18-Jul-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,400	4,400
		Insurance	1	LS	0.025	2,200	2,200
		Bonding	1	LS	0.025	2,200	2,200
		Contractor O&P	1	LS	0.150	13,200	13,200
		Sales Tax	1	LS	0.0725	6,380	6,380
Subtotal						28,380	28,380
		Earth/Site Work					
		Detention Basin Excavation	5,000	CY	0.00	0	0
		Laborer (2)	400	HR	45.00	18,000	18,000
		Foreman (1)	200	HR	60.00	12,000	12,000
		Operator/Driver (2)	400	HR	50.00	20,000	20,000
		Back Hoe Rental (1)	200	HR	70.00	14,000	14,000
		Dump Truck Rental (1)	200	HR	70.00	14,000	14,000
		Inlet/Outlet Structure	1	LS	10,000.00	10,000	10,000
Subtotal						88,000	88,000
Subtotal							$88,000
Division 010							$28,380
Construction Subtotal							$116,380
Cost per cubic yard of basin							$23
20% Contingency							$23,276
25% Legal, Admin., Engineering							$29,095
Project Subtotal							$168,751
20% Bonding							$33,750
New Subtotal							$202,501
Opinion of Probable Cost per Cubic Yard of Basin							**$41**
Engineers Opinion of Probable Construction Cost						CALL	**$203,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Strongs Creek Drainage: Riverwalk Drive Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,539	4,539
		Insurance	1	LS	0.025	2,269	2,269
		Bonding	1	LS	0.025	2,269	2,269
		Contractor O&P	1	LS	0.150	13,616	13,616
		Sales Tax	1	LS	0.0725	6,581	6,581
Subtotal						29,275	29,275
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,047	CY	6.30	6,598	6,598
	02315 100 1900	Backfill	819	CY	7.40	6,064	6,064
	02315 100 2200	Compacting (Vibrating Roller)	499	CY	5.30	2,647	2,647
	02315 130 0050	Bedding (River Run)	475	TON	20.00	9,504	9,504
	02320 200 0200	Hauling/Disposal (Excess Excavation)	228	CY	10.60	2,414	2,414
02500	02530 730 2040	HDPE Piping (30" Laid in Trench)	870	LF	37.00	32,190	32,190
02700	02720 200 0300	Road Aggregate Base (12" River Run)	287	TON	30.00	8,613	8,613
	02740 300 0200	AC Pavement (4")	126	TON	90.00	11,354	11,354
	02766 550 0200	Pavement Markings (6")	870	LF	1.60	1,392	1,392
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						90,776	90,776

Subtotal	$90,776
Division 010	$29,275
Construction Subtotal	$120,051
Cost per LF HDPE Installed	$138
20% Contingency	$24,010
25% Legal, Admin., Engineering	$30,013
Project Subtotal	$174,074
20% Bonding	$34,815
New Subtotal	$208,889
Opinion of Probable Cost per LF HDPE	**$240**
Engineers Opinion of Probable Construction Cost	**CALL** **$209,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Riverwalk Drive Project (alternative)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,123	4,123
		Insurance	1	LS	0.025	2,061	2,061
		Bonding	1	LS	0.025	2,061	2,061
		Contractor O&P	1	LS	0.150	12,368	12,368
		Sales Tax	1	LS	0.0725	5,978	5,978
Subtotal						26,591	26,591
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	773	CY	6.30	4,872	4,872
	02315 100 1900	Backfill	672	CY	7.40	4,974	4,974
	02315 100 2200	Compacting (Vibrating Roller)	354	CY	5.30	1,879	1,879
	02315 130 0050	Bedding (River Run)	472	TON	20.00	9,434	9,434
	02320 200 0200	Hauling/Disposal (Excess Excavation)	101	CY	10.60	1,073	1,073
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	870	LF	37.00	32,190	32,190
02700	02720 200 0300	Road Aggregate Base (12" River Run)	239	TON	30.00	7,178	7,178
	02740 300 0200	AC Pavement (4")	105	TON	90.00	9,461	9,461
	02766 550 0200	Pavement Markings (6")	870	LF	1.60	1,392	1,392
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						82,452	82,452

Subtotal	$82,452
Division 010	$26,591
Construction Subtotal	$109,043
Cost per LF HDPE Installed	$125
20% Contingency	$21,809
25% Legal, Admin., Engineering	$27,261
Project Subtotal	$158,113
20% Bonding	$31,623
New Subtotal	$189,735
Opinion of Probable Cost per LF HDPE	**$218**
Engineers Opinion of Probable Construction Cost	**CALL** **$190,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Alamar Way Project

Winzler & Kelly Consulting Engineers
Prepared By: MGK
Date Prepared: 18-Jul-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	11,117	11,117
		Insurance	1	LS	0.025	5,559	5,559
		Bonding	1	LS	0.025	5,559	5,559
		Contractor O&P	1	LS	0.150	33,352	33,352
		Sales Tax	1	LS	0.0725	16,120	16,120
Subtotal						71,706	71,706
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	2,022	CY	6.30	12,740	12,740
	02315 100 1900	Backfill	1,582	CY	7.40	11,710	11,710
	02315 100 2200	Compacting (Vibrating Roller)	700	CY	5.30	3,710	3,710
	02315 130 0050	Bedding (River Run)	1,310	TON	20.00	26,207	26,207
	02320 200 0200	Hauling/Disposal (Excess Excavation)	440	CY	10.60	4,662	4,662
02500	02530 730 2080	HDPE Piping (36" Laid in Trench)	1,680	LF	68.70	115,416	115,416
02700	02720 200 0300	Road Aggregate Base (12" River Run)	554	TON	30.00	16,632	16,632
	02740 300 0200	AC Pavement (4")	244	TON	90.00	21,924	21,924
	02766 550 0200	Pavement Markings (6")	840	LF	1.60	1,344	1,344
		Traffic Control	1	LS	5,000.00	5,000	5,000
		New Drop Inlet	1	EA	3,000.00	3,000	3,000
Subtotal						222,345	222,345
Subtotal							$222,345
Division 010							$71,706
Construction Subtotal							$294,051
Cost per LF HDPE Installed							$175
20% Contingency							$58,810
25% Legal, Admin., Engineering							$73,513
Project Subtotal							$426,375
20% Bonding							$85,275
New Subtotal							$511,650
Opinion of Probable Cost per LF HDPE							**$305**
Engineers Opinion of Probable Construction Cost						CALL	**$512,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Fortuna Boulevard Project No. 3

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	14-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,034	7,034
		Insurance	1	LS	0.025	3,517	3,517
		Bonding	1	LS	0.025	3,517	3,517
		Contractor O&P	1	LS	0.150	21,103	21,103
		Sales Tax	1	LS	0.0725	10,200	10,200
Subtotal						45,371	45,371
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,422	CY	6.30	8,960	8,960
	02315 100 1900	Backfill	1,236	CY	7.40	9,147	9,147
	02315 100 2200	Compacting (Vibrating Roller)	652	CY	5.30	3,455	3,455
	02315 130 0050	Bedding (River Run)	868	TON	20.00	17,351	17,351
	02320 200 0200	Hauling/Disposal (Excess Excavation)	186	CY	10.60	1,973	1,973
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	1,600	LF	37.00	59,200	59,200
02700	02720 200 0300	Road Aggregate Base (12" River Run)	440	TON	30.00	13,200	13,200
	02740 300 0200	AC Pavement (4")	193	TON	90.00	17,400	17,400
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						140,686	140,686

Subtotal	$140,686
Division 010	$45,371
Construction Subtotal	$186,057
Cost per LF HDPE Installed	$116
20% Contingency	$37,211
25% Legal, Admin., Engineering	$46,514
Project Subtotal	$269,783
20% Bonding	$53,957
New Subtotal	$323,739
Opinion of Probable Cost per LF HDPE	**$202**
Engineers Opinion of Probable Construction Cost CALL	**$324,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Maxwell Lane Slope Stabilization Project

(City Project No. 9700)

Estimate Type: [X] Conceptual

[ ] Preliminary (w/o plans)

[ ] Design Development @ 0 % Complete

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,482	3,482
		Insurance	1	LS	0.025	1,741	1,741
		Bonding	1	LS	0.025	1,741	1,741
		Contractor O&P	1	LS	0.150	10,447	10,447
		Sales Tax	1	LS	0.0725	5,049	5,049
Subtotal						22,461	22,461
		Earth/Site Work					
		Rock Slope Protection (Placed)	612	CY	100.00	61,200	61,200
		Laborer (1)	24	HR	45.00	1,102	1,102
		Foreman (1)	24	HR	60.00	1,469	1,469
		Operator/Driver (2)	49	HR	50.00	2,448	2,448
		Back Hoe Rental (1)	24	HR	70.00	1,714	1,714
		Dump Truck Rental (1)	24	HR	70.00	1,714	1,714
Subtotal						69,646	69,646
Subtotal							$69,646
Division 010							$22,461
Construction Subtotal							$92,106
Cost per linear foot of channel							$271
20% Contingency							$18,421
25% Legal, Admin., Engineering							$23,027
Project Subtotal							$133,554
20% Bonding							$26,711
New Subtotal							$160,265
Opinion of Probable Cost per LF of Channel							**$471**
Engineers Opinion of Probable Construction Cost						CALL	**$160,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Strongs Creek Drainage: Shamrock Drive to Redwood Way Project

(City Project No. 9703)

Estimate Type: [X] **Conceptual**

[ ] **Preliminary (w/o plans)**

[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By: MGK

Date Prepared: 22-Jun-05

W&K Proj. No. 04-1O5402-011

ENR: June 2005 7,415

Escalated to ENR

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	7,513	7,513
		Insurance	1	LS	0.025	3,756	3,756
		Bonding	1	LS	0.025	3,756	3,756
		Contractor O&P	1	LS	0.150	22,538	22,538
		Sales Tax	1	LS	0.0725	10,894	10,894
Subtotal						48,457	48,457
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,262	CY	6.30	7,952	7,952
	02315 100 1900	Backfill	1,097	CY	7.40	8,118	8,118
	02315 100 2200	Compacting (Vibrating Roller)	579	CY	5.30	3,066	3,066
	02315 130 0950	Bedding (River Run)	770	TON	20.00	15,399	15,399
	02320 200 0200	Hauling/Disposal (Excess Excavation)	165	CY	10.60	1,751	1,751
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	1,420	LF	37.00	52,540	52,540
		New Manhole	2	EA	5,000.00	10,000	10,000
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
02700	02720 200 0300	Road Aggregate Base (12" River Run)	391	TON	30.00	11,715	11,715
	02740 300 0200	AC Pavement (4")	172	TON	90.00	15,443	15,443
	02766 550 0200	Pavement Markings (6")	1,420	LF	1.60	2,272	2,272
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						150,256	150,256

Subtotal	$150,256
Division 010	$48,457
Construction Subtotal	$198,713
Cost per LF HDPE Installed	$140
20% Contingency	$39,743
25% Legal, Admin., Engineering	$49,678
Project Subtotal	$288,134
20% Bonding	$57,627
New Subtotal	$345,761
Opinion of Probable Cost per LF HDPE	**$243**
Engineers Opinion of Probable Construction Cost	**CALL** **$346,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Rohnerville Road Project No. 5

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,319	1,319
		Insurance	1	LS	0.025	659	659
		Bonding	1	LS	0.025	659	659
		Contractor O&P	1	LS	0.150	3,956	3,956
		Sales Tax	1	LS	0.0725	1,912	1,912
Subtotal						8,505	8,505
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	171	CY	6.30	1,078	1,078
	02315 100 1900	Backfill	128	CY	7.40	950	950
	02315 100 2200	Compacting (Vibrating Roller)	87	CY	5.30	459	459
	02315 130 0050	Bedding (River Run)	62	TON	20.00	1,238	1,238
	02320 200 0200	Hauling/Disposal (Excess Excavation)	43	CY	10.60	453	453
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	120	LF	37.00	4,440	4,440
02700	02720 200 0300	Road Aggregate Base (12" River Run)	40	TON	30.00	1,188	1,188
	02740 300 0200	AC Pavement (4")	17	TON	90.00	1,566	1,566
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						26,372	26,372

Subtotal	$26,372
Division 010	$8,505
Construction Subtotal	$34,877
Cost per LF HDPE Installed	$291
20% Contingency	$6,975
25% Legal, Admin., Engineering	$8,719
Project Subtotal	$50,572
20% Bonding	$10,114
New Subtotal	$60,687
Opinion of Probable Cost per LF HDPE	**$506**
Engineers Opinion of Probable Construction Cost CALL	**$61,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Strongs Creek Drainage: Rohnerville Road Project No. 3

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,703	2,703
		Insurance	1	LS	0.025	1,352	1,352
		Bonding	1	LS	0.025	1,352	1,352
		Contractor O&P	1	LS	0.150	8,109	8,109
		Sales Tax	1	LS	0.0725	3,920	3,920
Subtotal						17,435	17,435
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	477	CY	6.30	3,003	3,003
	02315 100 1900	Backfill	383	CY	7.40	2,831	2,831
	02315 100 2200	Compacting (Vibrating Roller)	212	CY	5.30	1,125	1,125
	02315 130 0050	Bedding (River Run)	253	TON	20.00	5,059	5,059
	02320 200 0200	Hauling/Disposal (Excess Excavation)	94	CY	10.60	997	997
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	60	LF	37.00	2,220	2,220
	02530 730 2040	HDPE Piping (30" Laid in Trench)	400	LF	37.00	14,800	14,800
02700	02720 200 0300	Road Aggregate Base (12" River Run)	130	TON	30.00	3,894	3,894
	02740 300 0200	AC Pavement (4")	57	TON	90.00	5,133	5,133
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						54,062	54,062

Subtotal	$54,062
Division 010	$17,435
Construction Subtotal	$71,498
Cost per LF HDPE Installed	$1,192
20% Contingency	$14,300
25% Legal, Admin., Engineering	$17,874
Project Subtotal	$103,671
20% Bonding	$20,734
New Subtotal	$124,406
Opinion of Probable Cost per LF HDPE	**$270**
Engineers Opinion of Probable Construction Cost	**CALL** **$125,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Rohnerville Road Project No. 4

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,741	2,741
		Insurance	1	LS	0.025	1,370	1,370
		Bonding	1	LS	0.025	1,370	1,370
		Contractor O&P	1	LS	0.150	8,223	8,223
		Sales Tax	1	LS	0.0725	3,974	3,974
Subtotal						17,679	17,679
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	450	CY	6.30	2,835	2,835
	02315 100 1900	Backfill	368	CY	7.40	2,725	2,725
	02315 100 2200	Compacting (Vibrating Roller)	200	CY	5.30	1,060	1,060
	02315 130 0050	Bedding (River Run)	250	TON	20.00	4,995	4,995
	02320 200 0200	Hauling/Disposal (Excess Excavation)	82	CY	10.60	867	867
02500	02530 730 2040	HDPE Piping (30" Laid in Trench)	450	LF	37.00	16,650	16,650
02700	02720 200 0300	Road Aggregate Base (12" River Run)	149	TON	30.00	4,455	4,455
	02740 300 0200	AC Pavement (4")	65	TON	90.00	5,873	5,873
	02766 550 0200	Pavement Markings (6")	225	LF	1.60	360	360
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						54,819	54,819

Subtotal	$54,819
Division 010	$17,679
Construction Subtotal	$72,499
Cost per LF HDPE Installed	$161
20% Contingency	$14,500
25% Legal, Admin., Engineering	$18,125
Project Subtotal	$105,123
20% Bonding	$21,025
New Subtotal	$126,148
Opinion of Probable Cost per LF HDPE	**$280**
Engineers Opinion of Probable Construction Cost	**CALL** **$126,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Loop Road Detention Basin Project
(City Project No. 9603)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,074	3,074
		Insurance	1	LS	0.025	1,537	1,537
		Bonding	1	LS	0.025	1,537	1,537
		Contractor O&P	1	LS	0.150	9,222	9,222
		Sales Tax	1	LS	0.0725	4,457	4,457
Subtotal						19,827	19,827
		Earth/Site Work					
		Detention Basin Excavation	3,300	CY	0.00	0	0
		Laborer (2)	264	HR	45.00	11,880	11,880
		Foreman (1)	132	HR	60.00	7,920	7,920
		Operator/Driver (2)	264	HR	50.00	13,200	13,200
		Back Hoe Rental (1)	132	HR	70.00	9,240	9,240
		Dump Truck Rental (1)	132	HR	70.00	9,240	9,240
		Inlet/Outlet Structures	1	LS	10,000.00	10,000	10,000
Subtotal						61,480	61,480

Subtotal	$61,480
Division 010	$19,827
Construction Subtotal	$81,307
Cost per cubic yard of basin	$25
20% Contingency	$16,261
25% Legal, Admin., Engineering	$20,327
Project Subtotal	$117,896
20% Bonding	$23,579
New Subtotal	$141,475
Opinion of Probable Cost per Cubic Yard of Basin	**$43**
Engineers Opinion of Probable Construction Cost	**CALL** **$142,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Strongs Creek Drainage: Loop Road Project

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 18-Jul-05
W&K Proj. No. 04-1054-02-011
ENR: June 2005 7,415
Escalated to ENR

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010.000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	633	633
		Insurance	1	LS	0.025	316	316
		Bonding	1	LS	0.025	316	316
		Contractor O&P	1	LS	0.150	1,899	1,899
		Sales Tax	1	LS	0.0725	918	918
Subtotal						4,082	4,082
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	154	CY	6.30	972	972
	02315 100 1900	Backfill	103	CY	7.40	765	765
	02315 100 2200	Compacting (Vibrating Roller)	49	CY	5.30	259	259
	02315 130 0050	Bedding (River Run)	81	TON	20.00	1,616	1,616
	02320 200 0200	Hauling/Disposal (Excess Excavation)	51	CY	10.60	540	540
02500	02530 730 2040	HDPE Piping (60" Laid in Trench)	70	LF	121.50	8,505	8,505
Subtotal						12,657	12,657
Subtotal							$12,657
Division 010							$4,082
Construction Subtotal							$16,739
Cost per LF HDPE Installed							$239
20% Contingency							$3,348
25% Legal, Admin., Engineering							$4,185
Project Subtotal							$24,271
20% Bonding							$4,854
New Subtotal							$29,125
Opinion of Probable Cost per LF HDPE							**$416**
Engineers Opinion of Probable Construction Cost						CALL	**$30,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: Ross Hill Road Culvert Replacement Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,670	4,670
		Insurance	1	LS	0.025	2,335	2,335
		Bonding	1	LS	0.025	2,335	2,335
		Contractor O&P	1	LS	0.150	14,010	14,010
		Sales Tax	1	LS	0.0725	6,772	6,772
Subtotal						30,122	30,122
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	617	CY	6.30	3,887	3,887
	02315 100 1900	Backfill	413	CY	7.40	3,059	3,059
	02315 100 2200	Compacting (Vibrating Roller)	163	CY	5.30	866	866
	02315 130 0050	Bedding (River Run)	371	TON	20.00	7,427	7,427
	02320 200 0200	Hauling/Disposal (Excess Excavation)	204	CY	10.60	2,158	2,158
	02530 730 2060	HDPE Piping (60" Laid in Trench)	280	LF	132.10	36,988	36,988
02700	02720 200 0300	Road Aggregate Base (12" River Run)	123	TON	30.00	3,696	3,696
	02740 300 0200	AC Pavement (4")	54	TON	90.00	4,872	4,872
	02766 550 0200	Pavement Markings (6")	280	LF	1.60	448	448
		Traffic Control	1	LS	30,000.00	30,000	30,000
Subtotal						93,402	93,402
Subtotal							$93,402
Division 010							$30,122
Construction Subtotal							$123,524
Cost per LF HDPE Installed							$441
20% Contingency							$24,705
25% Legal, Admin., Engineering							$30,881
Project Subtotal							$179,110
20% Bonding							$35,822
New Subtotal							$214,932
Opinion of Probable Cost per LF HDPE							**$768**
Engineers Opinion of Probable Construction Cost						CALL	**$215,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: Kenmar Road Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	4,041	4,041
		Insurance	1	LS	0.025	2,020	2,020
		Bonding	1	LS	0.025	2,020	2,020
		Contractor O&P	1	LS	0.150	12,123	12,123
		Sales Tax	1	LS	0.0725	5,859	5,859
Subtotal						26,064	26,064
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	768	CY	6.30	4,839	4,839
	02315 100 1900	Backfill	613	CY	7.40	4,539	4,539
	02315 100 2200	Compacting (Vibrating Roller)	323	CY	5.30	1,711	1,711
	02315 130 0050	Bedding (River Run)	432	TON	20.00	8,631	8,631
	02320 200 0200	Hauling/Disposal (Excess Excavation)	155	CY	10.60	1,640	1,640
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	160	LF	37.00	5,920	5,920
	02530 730 2050	HDPE Piping (36" Laid in Trench)	520	LF	52.80	27,456	27,456
02700	02720 200 0300	Road Aggregate Base (12" River Run)	216	TON	30.00	6,468	6,468
	02740 300 0200	AC Pavement (4")	95	TON	90.00	8,526	8,526
	02766 550 0200	Pavement Markings (6")	680	LF	1.60	1,088	1,088
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						80,819	80,819

Subtotal	$80,819
Division 010	$26,064
Construction Subtotal	$106,883
Cost per LF HDPE Installed	$157
20% Contingency	$21,377
25% Legal, Admin., Engineering	$26,721
Project Subtotal	$154,980
20% Bonding	$30,996
New Subtotal	$185,976
Opinion of Probable Cost per LF HDPE	**$273**
Engineers Opinion of Probable Construction Cost	**CALL** **$186,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Webber Street Culvert Replacement Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	724	724
		Insurance	1	LS	0.025	362	362
		Bonding	1	LS	0.025	362	362
		Contractor O&P	1	LS	0.150	2,172	2,172
		Sales Tax	1	LS	0.0725	1,050	1,050
Subtotal						4,671	4,671
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	108	CY	6.30	683	683
	02315 100 1900	Backfill	85	CY	7.40	627	627
	02315 100 2200	Compacting (Vibrating Roller)	38	CY	5.30	199	199
	02315 130 0050	Bedding (River Run)	70	TON	20.00	1,404	1,404
	02320 200 0200	Hauling/Disposal (Excess Excavation)	24	CY	10.60	250	250
02500	02530 730 2080	HDPE Piping (36" Laid in Trench)	90	LF	68.70	6,183	6,183
02700	02720 200 0300	Road Aggregate Base (12" River Run)	30	TON	30.00	891	891
	02740 300 0200	AC Pavement (4")	13	TON	90.00	1,175	1,175
	02766 550 0200	Pavement Markings (6")	45	LF	1.60	72	72
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						14,483	14,483
Subtotal							$14,483
Division 010							$4,671
Construction Subtotal							$19,153
Cost per LF HDPE Installed							$213
20% Contingency							$3,831
25% Legal, Admin., Engineering							$4,788
Project Subtotal							$27,773
20% Bonding							$5,555
New Subtotal							$33,327
Opinion of Probable Cost per LF HDPE							**$370**
Engineers Opinion of Probable Construction Cost						CALL	**$34,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: School Street Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,190	3,190
		Insurance	1	LS	0.025	1,595	1,595
		Bonding	1	LS	0.025	1,595	1,595
		Contractor O&P	1	LS	0.150	9,570	9,570
		Sales Tax	1	LS	0.0725	4,625	4,625
Subtotal						20,575	20,575
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	542	CY	6.30	3,416	3,416
	02315 100 1900	Backfill	471	CY	7.40	3,487	3,487
	02315 100 2200	Compacting (Vibrating Roller)	249	CY	5.30	1,317	1,317
	02315 130 0050	Bedding (River Run)	331	TON	20.00	6,615	6,615
	02320 200 0200	Hauling/Disposal (Excess Excavation)	71	CY	10.60	752	752
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	610	LF	37.00	22,570	22,570
		New Drop Inlet	1	EA	3,000.00	3,000	3,000
02700	02720 200 0300	Road Aggregate Base (12" River Run)	168	TON	30.00	5,033	5,033
	02740 300 0200	AC Pavement (4")	74	TON	90.00	6,634	6,634
	02766 550 0200	Pavement Markings (6")	610	LF	1.60	976	976
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						63,800	63,800
Subtotal							563,800
Division 010							520,575
Construction Subtotal							584,375
Cost per LF HDPE installed							$138
20% Contingency							$16,875
25% Legal, Admin., Engineering							$21,094
Project Subtotal							$122,344
20% Bonding							$24,469
New Subtotal							$146,813
Opinion of Probable Cost per LF HDPE							**$241**
Engineers Opinion of Probable Construction Cost						CALL	**$147,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Jones Street Storm Drain Project
(City Project No. 9809)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,972	2,972
		Insurance	1	LS	0.025	1,486	1,486
		Bonding	1	LS	0.025	1,486	1,486
		Contractor C&P	1	LS	0.150	8,915	8,915
		Sales Tax	1	LS	0.0725	4,309	4,309
Subtotal						19,167	19,167
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	525	CY	6.30	3,308	3,308
	02315 100 1900	Backfill	348	CY	7.40	2,577	2,577
	02315 100 2200	Compacting (Vibrating Roller)	49	CY	5.30	258	258
	02315 130 0050	Bedding (River Run)	445	TON	20.00	8,897	8,897
	02320 200 0200	Hauling/Disposal (Excess Excavation)	177	CY	10.60	1,873	1,873
02500	02530 730 2030	HDPE Piping (18" Laid in Trench)	675	LF	26.40	17,820	17,820
		New Drop Inlet	3	EA	3,000.00	9,000	9,000
02700	02720 200 0300	Road Aggregate Base (12" River Run)	167	TON	30.00	5,012	5,012
	02740 300 0200	AC Pavement (4")	73	TON	90.00	6,607	6,607
	02766 550 0200	Pavement Markings (6")	675	LF	1.60	1,080	1,080
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						59,432	59,432
Subtotal							$59,432
Division 010							$19,167
Construction Subtotal							$78,599
Cost per LF HDPE Installed							$116
20% Contingency							$15,720
25% Legal, Admin., Engineering							$19,650
Project Subtotal							$113,968
20% Bonding							$22,794
New Subtotal							$136,762
Opinion of Probable Cost per LF HDPE							**$203**
Engineers Opinion of Probable Construction Cost						**CALL**	**$137,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Jones Street Detention Basin Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type:
- [X] Conceptual
- [ ] Preliminary (w/o plans)
- [ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,560	1,560
		Insurance	1	LS	0.025	780	780
		Bonding	1	LS	0.025	780	780
		Contractor O&P	1	LS	0.150	4,680	4,680
		Sales Tax	1	LS	0.0725	2,262	2,262
Subtotal						10,062	10,062
		Earth/Site Work					
		Detention Basin Excavation	2,000	CY	0.00	0	0
		Laborer (2)	160	HR	45.00	7,200	7,200
		Foreman (1)	80	HR	60.00	4,800	4,800
		Operator/Driver (2)	160	HR	50.00	8,000	8,000
		Back Hoe Rental (1)	80	HR	70.00	5,600	5,600
		Dump Truck Rental (1)	80	HR	70.00	5,600	5,600
Subtotal						31,200	31,200

Subtotal	$31,200
Division 010	$10,062
Construction Subtotal	$41,262
Cost per Cubic Yard of Detention	$21
20% Contingency	$8,252
25% Legal, Admin., Engineering	$10,316
Project Subtotal	$59,830
20% Bonding	$11,966
New Subtotal	$71,796
Opinion of Probable Cost per Cubic Yard of Detention	**$36**
Engineers Opinion of Probable Construction Cost	**CALL** **$72,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Mill Street Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,176	1,176
		Insurance	1	LS	0.025	588	588
		Bonding	1	LS	0.025	588	588
		Contractor O&P	1	LS	0.150	3,529	3,529
		Sales Tax	1	LS	0.0725	1,706	1,706
Subtotal						7,588	7,588
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	128	CY	6.30	809	809
	02315 100 1900	Backfill	96	CY	7.40	712	712
	02315 100 2200	Compacting (Vibrating Roller)	65	CY	5.30	345	345
	02315 130 0050	Bedding (River Run)	46	TON	20.00	929	929
	02320 200 0200	Hauling/Disposal (Excess Excavation)	32	CY	10.60	340	340
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	90	LF	37.00	3,330	3,330
02700	02720 200 0300	Road Aggregate Base (12" River Run)	30	TON	30.00	891	891
	02740 300 0200	AC Pavement (4")	13	TON	90.00	1,175	1,175
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						23,529	23,529

Subtotal	$23,529
Division 010	$7,588
Construction Subtotal	$31,117
Cost per LF HDPE Installed	$346
20% Contingency	$6,223
25% Legal, Admin., Engineering	$7,779
Project Subtotal	$45,120
20% Bonding	$9,024
New Subtotal	$54,144
Opinion of Probable Cost per LF HDPE	**$602**
Engineers Opinion of Probable Construction Cost	**CALL** **$54,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: School Street Project No. 2

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,209	1,209
		Insurance	1	LS	0.025	605	605
		Bonding	1	LS	0.025	605	605
		Contractor O&P	1	LS	0.150	3,628	3,628
		Sales Tax	1	LS	0.0725	1,754	1,754
Subtotal						7,801	7,801
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	150	CY	6.30	945	945
	02315 100 1900	Backfill	108	CY	7.40	800	800
	02315 100 2200	Compacting (Vibrating Roller)	80	CY	5.30	424	424
	02315 130 0050	Bedding (River Run)	42	TON	20.00	835	835
	02320 200 0200	Hauling/Disposal (Excess Excavation)	42	CY	10.60	444	444
02500	02530 730 2040	HDPE Piping (48" Laid in Trench)	90	LF	37.00	3,330	3,330
02700	02720 200 0300	Road Aggregate Base (12" River Run)	35	TON	30.00	1,040	1,040
	02740 300 0200	AC Pavement (4")	15	TON	90.00	1,370	1,370
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						24,188	24,188

Subtotal	$24,188
Division 010	$7,801
Construction Subtotal	$31,988
Cost per LF HDPE Installed	$355
20% Contingency	$6,398
25% Legal, Admin., Engineering	$7,997
Project Subtotal	$46,383
20% Bonding	$9,277
New Subtotal	$55,660
Opinion of Probable Cost per LF HDPE	**$618**
Engineers Opinion of Probable Construction Cost	**CALL** **$56,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: West School Street Project
(City Project No. 9504)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	11,450	11,450
		Insurance	1	LS	0.025	5,725	5,725
		Bonding	1	LS	0.025	5,725	5,725
		Contractor O&P	1	LS	0.150	34,350	34,350
		Sales Tax	1	LS	0.0725	16,603	16,603
Subtotal						73,853	73,853
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,910	CY	6.30	12,033	12,033
	02315 100 1900	Backfill	1,648	CY	7.40	12,198	12,198
	02315 100 2200	Compacting (Vibrating Roller)	861	CY	5.30	4,563	4,563
	02315 130 0050	Bedding (River Run)	1,169	TON	20.00	23,390	23,390
	02320 200 0200	Hauling/Disposal (Excess Excavation) *	262	CY	10.60	2,773	2,773
02500	02530 730 2040	HDPE Piping (18" Laid in Trench)	830	LF	37.00	30,710	30,710
	02530 730 2040	HDPE Piping (24" Laid in Trench)	500	LF	37.00	18,500	18,500
	02530 730 2050	HDPE Piping (30" Laid in Trench)	820	LF	52.80	43,296	43,296
02700	02720 200 0300	Road Aggregate Base (12" River Run)	591	TON	30.00	17,729	17,729
	02740 300 0200	AC Pavement (4")	260	TON	90.00	23,370	23,370
	02766 550 0200	Pavement Markings (6")	2,150	LF	1.60	3,440	3,440
		New Manholes (48")	2	EA	5,000.00	10,000	10,000
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
		Traffic Control	1	LS	15,000.00	15,000	15,000
Subtotal						229,002	229,002
Subtotal							$229,002
Division 010							$73,853
Construction Subtotal							$302,855
Cost per LF HDPE Installed							$228
20% Contingency							$60,571
25% Legal, Admin., Engineering							$75,714
Project Subtotal							$439,140
20% Bonding							$87,828
New Subtotal							$526,969
Opinion of Probable Cost per LF HDPE							**$396**
Engineers Opinion of Probable Construction Cost						**CALL**	**$527,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: Thomas Street Project (City Project No. 9806)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	2,904	2,904
		Insurance	1	LS	0.025	1,452	1,452
		Bonding	1	LS	0.025	1,452	1,452
		Contractor O&P	1	LS	0.150	8,712	8,712
		Sales Tax	1	LS	0.0725	4,211	4,211
Subtotal						18,731	18,731
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	521	CY	6.30	3,283	3,283
	02315 100 1900	Backfill	346	CY	7.40	2,558	2,558
	02315 100 2200	Compacting (Vibrating Roller)	48	CY	5.30	256	256
	02315 130 0050	Bedding (River Run)	442	TON	20.00	8,831	8,831
	02320 200 0200	Hauling/Disposal (Excess Excavation)	175	CY	10.60	1,859	1,859
02500	02530 730 2030	HDPE Piping (18" Laid in Trench)	670	LF	26.40	17,688	17,688
02700	02720 200 0300	New Drop Inlet	2	EA	3,000.00	6,000	6,000
	02740 300 0200	Road Aggregate Base (12" River Run)	166	TON	30.00	4,975	4,975
	02766 550 0200	AC Pavement (4")	73	TON	90.00	6,558	6,558
		Pavement Markings (6")	670	LF	1.60	1,072	1,072
		Traffic Control	1	LS	5,000.00	5,000	5,000
Subtotal						58,081	58,081

Subtotal	$58,081
Division 010	$18,731
Construction Subtotal	$76,812
Cost per LF HDPE Installed	$115
20% Contingency	$15,362
25% Legal, Admin., Engineering	$19,203
Project Subtotal	$111,377
20% Bonding	$22,275
New Subtotal	$133,652
Opinion of Probable Cost per LF HDPE	**$199**
Engineers Opinion of Probable Construction Cost	**CALL** **$134,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Campton Heights Drive Project
(City Project No. 9805)

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Winzler & Kelly Consulting Engineers

Prepared By: MGK
Date Prepared: 22-Jun-05
W&K Proj. No. 04-105402-011
ENR: June 2005 7,415
Escalated to ENR

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,951	1,951
		Insurance	1	LS	0.025	975	975
		Bonding	1	LS	0.025	975	975
		Contractor O&P	1	LS	0.150	5,853	5,853
		Sales Tax	1	LS	0.0725	2,829	2,829
Subtotal						12,583	12,583
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	300	CY	6.30	1,890	1,890
	02315 100 1900	Backfill	216	CY	7.40	1,600	1,600
	02315 100 2200	Compacting (Vibrating Roller)	38	CY	5.30	199	199
	02315 130 0050	Bedding (River Run)	265	TON	20.00	5,308	5,308
	02320 200 0200	Hauling/Disposal (Excess Excavation)	84	CY	10.60	888	888
02500	02530 730 2030	HDPE Piping (48" Laid in Trench)	180	LF	105.70	19,026	19,026
		Road Aggregate Base (12" River Run)	69	TON	30.00	2,079	2,079
02700	02720 200 0300	AC Pavement (4")	30	TON	90.00	2,741	2,741
	02740 300 0200	Pavement Markings (6")	180	LF	1.60	288	288
	02766 550 0200	Traffic Control	1	LS	5,000.00	5,000	5,000
Subtotal						39,018	39,018
Subtotal							$39,018
Division 010							$12,583
Construction Subtotal							$51,602
Cost per LF HDPE Installed							$287
20% Contingency							$10,320
25% Legal, Admin., Engineering							$12,900
Project Subtotal							$74,823
20% Bonding							$14,965
New Subtotal							$89,787
Opinion of Probable Cost per LF HDPE							$499
Engineers Opinion of Probable Construction Cost						CALL	**$90,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Cecil Avenue Project No. 1

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	724	724
		Insurance	1	LS	0.025	362	362
		Bonding	1	LS	0.025	362	362
		Contractor O&P	1	LS	0.150	2,172	2,172
		Sales Tax	1	LS	0.0725	1,050	1,050
Subtotal						4,671	4,671
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	108	CY	6.30	683	683
	02315 100 1900	Backfill	85	CY	7.40	627	627
	02315 100 2200	Compacting (Vibrating Roller)	38	CY	5.30	199	199
	02315 130 0050	Bedding (River Run)	70	TON	20.00	1,404	1,404
	02320 200 0200	Hauling/Disposal (Excess Excavation)	24	CY	10.60	250	250
02500	02530 730 2080	HDPE Piping (36" Laid in Trench)	90	LF	68.70	6,183	6,183
02700	02720 200 0300	Road Aggregate Base (12" River Run)	30	TON	30.00	891	891
	02740 300 0200	AC Pavement (4")	13	TON	90.00	1,175	1,175
	02766 550 0200	Pavement Markings (6")	45	LF	1.60	72	72
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						14,483	14,483
Subtotal							$14,483
Division 010							$4,671
Construction Subtotal							$19,153
Cost per LF HDPE Installed							$213
20% Contingency							$3,831
25% Legal, Admin., Engineering							$4,788
Project Subtotal							$27,773
20% Bonding							$5,555
New Subtotal							$33,327
Opinion of Probable Cost per LF HDPE							**$370**
Engineers Opinion of Probable Construction Cost						CALL	**$34,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

North Fortuna Drainage: Main Street Project No. 2

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	3,951	3,951
		Insurance	1	LS	0.025	1,976	1,976
		Bonding	1	LS	0.025	1,976	1,976
		Contractor O&P	1	LS	0.150	11,854	11,854
		Sales Tax	1	LS	0.0725	5,729	5,729
Subtotal						25,486	25,486
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	674	CY	6.30	4,247	4,247
	02315 100 1900	Backfill	633	CY	7.40	4,687	4,687
	02315 100 2200	Compacting (Vibrating Roller)	355	CY	5.30	1,882	1,882
	02315 130 0050	Bedding (River Run)	413	TON	20.00	8,266	8,266
	02220 200 0200	Hauling/Disposal /Excess Excavation)	41	CY	10.60	432	432
02500	02530 730 2040	HDPE Piping (54" Laid in Trench)	350	LF	121.50	42,525	42,525
02700	02720 200 0300	Road Aggregate Base (12" River Run)	135	TON	30.00	4,043	4,043
	02740 300 0200	AC Pavement (4")	30	TON	90.00	2,664	2,664
	02766 550 0200	Pavement Markings (6")	175	LF	1.60	280	280
		Traffic Control	1	LS	10,000.00	10,000	10,000
Subtotal						79,025	79,025

Subtotal	$79,025
Division 010	$25,486
Construction Subtotal	$104,510
Cost per LF HDPE Installed	$299
20% Contingency	$20,902
25% Legal, Admin., Engineering	$26,128
Project Subtotal	$151,540
20% Bonding	$30,308
New Subtotal	$181,848
Opinion of Probable Cost per LF HDPE	**$520**
Engineers Opinion of Probable Construction Cost	**CALL** **$182,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Bridle Creek Project (alternative)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,982	1,982
		Insurance	1	LS	0.025	991	991
		Bonding	1	LS	0.025	991	991
		Contractor O&P	1	LS	0.150	5,945	5,945
		Sales Tax	1	LS	0.0725	2,873	2,873
Subtotal						12,782	12,782
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	692	CY	6.30	4,357	4,357
	02315 100 1900	Backfill	519	CY	7.40	3,839	3,839
	02315 100 2200	Compacting (Vibrating Roller)	350	CY	5.30	1,856	1,856
	02315 130 0050	Bedding (River Run)	250	TON	20.00	5,004	5,004
	02320 200 0200	Hauling/Disposal (Excess Excavation)	173	CY	10.60	1,832	1,832
02500	02530 730 2040	HDPE Piping (42" Laid in Trench)	485	LF	37.00	17,945	17,945
02700	02720 200 0300	Road Aggregate Base (12" River Run)	160	TON	30.00	4,802	4,802
Subtotal						39,634	39,634

Subtotal	$39,634
Division 010	$12,782
Construction Subtotal	$52,416
Cost per LF HDPE Installed	$108
20% Contingency	$10,483
25% Legal, Admin., Engineering	$13,104
Project Subtotal	$76,004
20% Bonding	$15,201
New Subtotal	$91,204
Opinion of Probable Cost per LF HDPE	**$188**
Engineers Opinion of Probable Construction Cost	**CALL** **$91,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: Bridle Creek Project (alternative)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	15-Jul-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,717	1,717
		Insurance	1	LS	0.025	858	858
		Bonding	1	LS	0.025	858	858
		Contractor O&P	1	LS	0.150	5,151	5,151
		Sales Tax	1	LS	0.0725	2,490	2,490
Subtotal						11,075	11,075
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	431	CY	6.30	2,716	2,716
	02315 100 1900	Backfill	375	CY	7.40	2,773	2,773
	02315 100 2200	Compacting (Vibrating Roller)	198	CY	5.30	1,047	1,047
	02315 130 0050	Bedding (River Run)	263	TON	20.00	5,259	5,259
	02320 200 0200	Hauling/Disposal (Excess Excavation)	56	CY	10.60	598	598
02500	02530 730 2040	HDPE Piping (24" Laid in Trench)	485	LF	37.00	17,945	17,945
02700	02720 200 0300	Road Aggregate Base (12" River Run)	133	TON	30.00	4,001	4,001
Subtotal						34,340	34,340

Subtotal	$34,340
Division 010	$11,075
Construction Subtotal	$45,414
Cost per LF HDPE Installed	$94
20% Contingency	$9,083
25% Legal, Admin., Engineering	$11,354
Project Subtotal	$65,851
20% Bonding	$13,170
New Subtotal	$79,021
Opinion of Probable Cost per LF HDPE	**$163**
Engineers Opinion of Probable Construction Cost CALL	**$79,000**

ENGINEER'S OPINION OF PROBABLE COST

Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Bartlett Drive & Rohnerville Road Project

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	18-Jul-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	9,043	9,043
		Insurance	1	LS	0.025	4,522	4,522
		Bonding	1	LS	0.025	4,522	4,522
		Contractor O&P	1	LS	0.150	27,129	27,129
		Sales Tax	1	LS	0.0725	13,113	13,113
Subtotal						58,328	58,328
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	1,565	CY	6.30	9,858	9,858
	02315 100 1900	Backfill	1,224	CY	7.40	9,061	9,061
	02315 100 2200	Compacting (Vibrating Roller)	542	CY	5.30	2,871	2,871
	02315 130 0050	Bedding (River Run)	1,014	TON	20.00	20,279	20,279
	02320 200 0200	Hauling/Disposal (Excess Excavation)	340	CY	10.60	3,608	3,608
02500	02530 730 2080	HDPE Piping (36" Laid in Trench)	1,300	LF	68.70	89,310	89,310
02700	02720 200 0300	Road Aggregate Base (12" River Run)	429	TON	30.00	12,870	12,870
	02740 300 0200	AC Pavement (4")	189	TON	90.00	16,965	16,965
	02766 550 0200	Pavement Markings (6")	650	LF	1.60	1,040	1,040
		New Drop Inlet	4	EA	3,000.00	12,000	12,000
		Traffic Control	1	LS	3,000.00	3,000	3,000
Subtotal						180,862	180,862
Subtotal							$180,862
Division 010							$58,328
Construction Subtotal							$239,190
Cost per LF HDPE Installed							$184
20% Contingency							$47,838
25% Legal, Admin., Engineering							$59,798
Project Subtotal							$346,826
20% Bonding							$69,365
New Subtotal							$416,191
Opinion of Probable Cost per LF HDPE							**$320**
Engineers Opinion of Probable Construction Cost						CALL	**$416,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: **FORTUNA STORM DRAINAGE MASTER PLAN**

Mill Creek Drainage: Osprey Terrace Detention Basin Project
(City Project No. 9804)

Estimate Type: [X] **Conceptual**
[ ] **Preliminary (w/o plans)**
[ ] **Design Development @** 0 **% Complete**

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	**04-105402-011**
ENR: June 2005	7,415
Escalated to ENR	

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	1,932	1,932
		Insurance	1	LS	0.025	966	966
		Bonding	1	LS	0.025	966	966
		Contractor O&P	1	LS	0.150	5,796	5,796
		Sales Tax	1	LS	0.0725	2,801	2,801
Subtotal						12,461	12,461
02300		**Earth/Site Work**					
		Detention Basin Excavation	2,800	CY	0.00	0	0
		Laborer (1)	112	HR	45.00	5,040	5,040
		Foreman (1)	112	HR	60.00	6,720	6,720
		Operator/Driver (2)	224	HR	50.00	11,200	11,200
		Back Hoe Rental (1)	112	HR	70.00	7,840	7,840
		Dump Truck Rental (1)	112	HR	70.00	7,840	7,840
Subtotal						38,640	38,640
Subtotal							$38,640
Division 010							$12,461
Construction Subtotal							$51,101
Cost per cubic yard of basin							$18
20% Contingency							$10,220
25% Legal, Admin., Engineering							$12,775
Project Subtotal							$74,097
20% Bonding							$14,819
New Subtotal							$88,916
Opinion of Probable Cost per Cubic Yard of Basin							**$32**
Engineers Opinion of Probable Construction Cost						**CALL**	**$89,000**

ENGINEER'S OPINION OF PROBABLE COST
Project: FORTUNA STORM DRAINAGE MASTER PLAN

Mill Creek Drainage: Cecil Avenue Project No. 2 (City Project No. 9405)

Winzler & Kelly Consulting Engineers

Prepared By:	MGK
Date Prepared:	22-Jun-05
W&K Proj. No.	04-105402-011
ENR: June 2005	7,415
Escalated to ENR	

Estimate Type: [X] Conceptual
[ ] Preliminary (w/o plans)
[ ] Design Development @ 0 % Complete

Division	Item No.	Description	Qty	Units	Equipment $/Unit	Equipment Total	Total
010 000		**General Requirements**					
		Mobilization/Demobilization	1	LS	0.050	11,692	11,692
		Insurance	1	LS	0.025	5,846	5,846
		Bonding	1	LS	0.025	5,846	5,846
		Contractor O&P	1	LS	0.150	35,077	35,077
		Sales Tax	1	LS	0.0725	16,954	16,954
Subtotal						75,415	75,415
02300		**Earth/Site Work**					
	02315 900 0110	Trench Excavation	3,217	CY	6.30	20,265	20,265
	02315 100 1900	Backfill	2,318	CY	7.40	17,156	17,156
	02315 100 2200	Compacting (Vibrating Roller)	965	CY	5.30	5,115	5,115
	02315 130 0050	Bedding (River Run)	2,010	TON	20.00	40,196	40,196
	02320 200 0200	Hauling/Disposal (Excess Excavation)	898	CY	10.60	9,522	9,522
02500	02530 730 2030	HDPE Piping (48" Laid in Trench)	1,930	LF	68.70	132,591	132,591
		New Drop Inlets	3	EA	3,000.00	9,000	9,000
Subtotal						233,844	233,844
Subtotal							$233,844
Division 010							$75,415
Construction Subtotal							$309,259
Cost per LF HDPE Installed							$160
20% Contingency							$61,852
25% Legal, Admin., Engineering							$77,315
Project Subtotal							$448,426
20% Bonding							$89,685
New Subtotal							$538,111
Opinion of Probable Cost per LF HDPE							**$279**
Engineers Opinion of Probable Construction Cost						CALL	**$538,000**