RECOMMENDED ACTION AND JUSTIFICATION:
Public Hearing: To notify the general public about the accomplishments of a grant to develop a Drainage Study for the town of Coulterville; and, it is recommended that the Board of Supervisors accept the final report.

BACKGROUND AND HISTORY OF BOARD ACTIONS:
On July 19, 2005, the Board of Supervisors authorized staff to proceed with the development of a Project Design Phase for a PT/A Community Development Block Grant (CDBG) grant application to retain an advisor to develop a drainage study.

On September 13, 2005, a Public Hearing was held for Application Submittal Phase for the CDBG Planning/Technical Assistance Grant Program to retain a consultant to develop the drainage study.

On December 14, 2005, the Department of Housing and Community Development of the State of California notified the County of Mariposa of the grant award.

On June 5, 2006, the County received the CDBG Agreement #05—PTAA-1455, from the Department of Housing and Community Development, authorizing the commencement of the project.

On November 14, 2006, the Board of Supervisors approved a Resolution and authorized the award of a Professional Service Agreement in the amount of $33,000 to Schaaf & Wheeler Consulting Engineering Civil Engineers to develop a drainage study for the town of Coulterville.

On September 11, 2007, the Board of Supervisors authorized the amendment of the Professional Service Agreement with Schaaf & Wheeler. The amendment was to increase the Agreement in the amount of $250 to cover required analytical service for the balance of the report.

The Public Hearing Notice was published on November 22, 2007.

ALTERNATIVES AND CONSEQUENCES OF NEGATIVE ACTION:
Not approving the requested action will result in negative impacts relative to the Agreement between the State of California Department of Housing and Community Development and County of Mariposa, placing the County in a default position.

Financial Impact? ( ) Yes ( ) No
Budgeted in Current FY? ( ) Yes ( ) No
Partially Funded

Current FY Cost: $0
Annual Recurring Cost: $0

Additional Funding Needed: $0
Source:
Internal Transfer
Unanticipated Revenue: 4/5's vote
Transfer Between Funds: 4/5's vote
Contingency: 4/5's vote
Other:

Drainage Study Report for the town of Coulterville,
Page 1 - 23
The foregoing instrument is a correct copy of the original on file in this office.

Date: ____________________________

Attest: MARGIE WILLIAMS, Clerk of the Board
        County of Mariposa, State of California

By: ______________________________
    Deputy

ml.Grants Gen Allocation grant closeout Agenda Trans Form

Revised Dec. 2003
COUNTY of MARIPOSA
P.O. Box 784, Mariposa, CA 95338 (209) 966-3222

JANET BIBBY, CHAIR
LYLE TURPIN, VICE CHAIR
BRAD ABORN
DIANNE A. FRITZ
BOB PICKARD

DISTRICT III
DISTRICT II
DISTRICT I
DISTRICT IV
DISTRICT V

MARIPOSA COUNTY BOARD OF SUPERVISORS
MINUTE ORDER

TO: RICHARD J. BENSON, CAO
FROM: MARGIE WILLIAMS, Clerk of the Board

SUBJECT: PUBLIC HEARING to Notify the General Public of the Accomplishments of the Drainage Study for the Town of Coulterville Funded by the State of California Department of Housing and Community Development CDBG/Planning and Technical Assistance Program; and for the Board of Supervisors to Accept the Final Report

RESOLUTION 07-554

THE BOARD OF SUPERVISORS OF MARIPOSA COUNTY, CALIFORNIA

ADOPTED THIS Order on December 4, 2007

ACTION AND VOTE:

Richard J. Benson, County Administrative Officer, and Dana Hertfelder, Public Works Director; PUBLIC HEARING to Notify the General Public of the Accomplishments of the Drainage Study for the Town of Coulterville Funded by the State of California Department of Housing and Community Development CDBG/Planning and Technical Assistance Program; and for the Board of Supervisors to Accept the Final Report

BOARD ACTION: Marilyn Lidyoff, Administration-Business Development Coordinator, and Rick Benson presented the staff report; and they responded to questions from the Board relative to being able to obtain color maps of the area, and relative to future updates to the study to reflect any development that may occur.

The public portion of the hearing was opened and input was provided by the following:

Eleanor Keuning, Historical Sites and Records Preservation Commission, questioned whether a future project would include any consideration of disturbance of any historic path or walk, or roads or any Native American artifacts. Dana Hertfelder, Public Works Director, advised that most of the work would occur in the existing roadway; however, the environmental study would determine if there are any impacts.

Mary Ann Huff, resident of Coulterville, stated she supports this grant and she feels the work would help to protect the historic buildings.

The public portion of the hearing was closed and the Board commenced with deliberations.

(M)Turpin, (S)Aborn, Res. 07-554 was adopted accepting the final report/Ayes: Unanimous. The hearing was closed.

Cc: Dana Hertfelder, Public Works Director
Marilyn Lidyoff, Business Development Coordinator
File
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Overview
Hydraulic analysis has been undertaken to determine existing storm drain deficiencies within the Town of Coulterville. The county of Mariposa has helped determine locations where flooding has occurred in the past. Storm drain improvements will help mitigate flooding on public and private properties.

STUDY OBJECTIVES
The objective of this document is to provide an examination of local flood risks within Coulterville, and list recommended projects necessary to mitigate risks to an appropriate level. Specifically, this study identifies capital improvements needed to provide a level of flood protection consistent with the goals set forth by the County of Mariposa. Several objectives have been accomplished:

1. A geographical information system (GIS) based storm drain system model for the entire City has been built; allowing county staff, other engineers, and developers to easily locate relevant data on a computer screen.

2. Storm drainage criteria for various system elements are presented. These criteria will govern future infrastructure design; and are used to evaluate the performance of existing facilities, and plan remedial improvements.

3. The ability of existing storm drain facilities throughout Coulterville to meet these criteria has been evaluated. System deficiencies may pose a risk to public safety and infrastructure damage.

4. Projects that can improve storm drain operations are identified.

5. Storm drain improvement costs are summarized.
BACKGROUND AND STORM DRAIN INVENTORY
This section provides a general background of flood management issues currently affecting the Town of Coulterville. Hydrologic and environmental settings are described, along with historic flooding and storm drain facilities are discussed herein.

Hydrologic and Environmental Settings
Coulterville is located in northern Mariposa County approximately 22 miles northeast of Mariposa. The town sits on the lower portion of a grass valley where highway CA-49 and highway CA-132 intersect. Coulterville Valley gradually slopes from the northeast to southwest, with the town of Coulterville just north of Maxwell Creek. Figure 1 shows Coulterville in its regional context.

Figure 1: Vicinity Map
Figure 2 delineates the Town's major drainage area, all of which drain by gravity via pipes and channels. The study area is defined as the Coulterville Watershed and more specifically the network of ditches, channels and drainage pipes within the drainage basin. The total watershed is roughly 200 acres.

![Map of Coulterville Watershed]

**Figure 2: Coulterville Watershed**

**Climate**

Coulterville's climate is semiarid with an average summertime high temperature of 91°F, dropping to an average winter nighttime low temperature of 32°F. Mean annual precipitation is roughly 31 inches, with about 80 percent of that precipitation falling from November through March. Precipitation occurs almost entirely as rainfall. Snowmelt is not a hydrologic process that significantly affects runoff in the Town.

**Geology**

The Natural Resources Conservation Service (NRCS) has classified all soils into four hydrologic soil groups (A, B, C, and D) according to their infiltration rate, which
correlates to its ability to absorb and transmit water; this aids in the determination of total runoff. Much of Coulterville was built on soils with hydrologic group D, which has a high runoff potential due to slow infiltration rates. However, part of the town is classified as group C, which has a moderately slow infiltration rates. The varied geologic settings affect the magnitude of flood risk experienced throughout the Town. A map of the Town of Coulterville along with the soil groups is shown in Figure 3.

Figure 3: NRCS Hydrologic Soil Groups
Land Use

Coulterville has two land uses Mountain Home Zone (MHZ) and Town Planning Area (TPA). MHZ is located in the northern section of Coulterville encompassing 33% of the total 200 acre land use area. The area delineated as TPA covers the town of Coulterville and allows for future development to the north. Land uses for Coulterville are shown in Figure 4.

For this study the entire area shown in Figure 4 is assumed fully developed. The area designated MHZ and TPA has a housing lot density of 0.2 unit/acre and 1 unit/acre, respectively. Table 1 itemizes land uses and assumed, SCS curve number and percent impervious area for each land use.

Figure 4: Land use
Table 1: Land Use Characteristics

<table>
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<th>LAND USE</th>
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<tr>
<td>MOUNTAIN HOME ZONE</td>
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<td>80</td>
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**Existing Storm Drain Facilities**

Runoff from upper areas of the town are conveyed by natural channels and culverts that range in size and slope. Once entering the town, runoff is conveyed within the storm drain infrastructure, consisting of Corrugated Metal Pipe (CMP) and Reinforced Concrete Pipe (RCP). These systems interact with one another, and potential improvements to one system may impact the performance of other systems, either positively or negatively. Majority of the runoff, collected by the storm drain, is discharged to an outfall operated and maintained by the California Department of Transportation, Caltrans. The outfall discharges to a small side channel that flows into Maxwell Creek approximately 170 feet downstream, the outfall and side channel are shown in Figure 5. All the existing storm drain facilities within Coulterville are shown in Figure 8.

**History of flooding**

Heavy rainfall in the winter months produces flood situations in the Town of Coulterville. Most of the runoff within Coulterville is routed through a small channel/ditch that flows through private properties. The channel is not properly sized or constructed and causes flooding during large storm events. A picture of the small channel between Broadway and Main Street is shown in Figure 6. This channel drains to an undersized inlet on Park Lane next to the public pool and park. Past storm events have flooded this area, damaging private and public property and has been a nuisance to property owners it directly and indirectly effects.
Figure 5: Caltrans Outfall

Figure 6: Drainage Channel between Main St. & Broadway Ave.
Methodologies

The criteria used to evaluate storm drain system performance must be defensible yet simple to understand and apply. As discussed in this section and the next, storm drain evaluation criteria were developed with input from the Town of Coulterville and based on engineering judgment.

A program designed by the Danish Hydraulic Institute (DHI) was selected to model the Town of Coulterville’s storm drain facilities because it is the best available, tested and reliable software with a GIS interface. MOUSE is used for the analysis, design and management of drainage systems, including storm water sewers and sanitary sewers. The MOUSE model works with add-on modules to ArcView GIS and can simulate surface runoff, open channel flow, pipe flow, water quality and sediment transport. The program has been chosen to model the Coulterville storm drain system because these capabilities.

For model validity, flow rates entering the Caltrans 60” storm drain were calculated by Schaaf & Wheeler for both the 10-year and 100-year storm events and compared to flow rates using the Rational Method and Caltrans Method. Variables for the Rational and Caltrans Methods (i.e., intensities, runoff coefficients, etc.) were found in the Mariposa County Improvement Standards (Oct. 12, 1999). The flow rates calculated by Schaaf & Wheeler were consistent with both methods; however, it should be noted that the Caltrans Method yielded a higher flow rate for the 100-year event.

DATA SOURCES AND INADEQUACIES

A general layout of the Town, including storm drain locations, was provided by the County of Mariposa, as well as, surveyed utility data that includes; existing storm drain invert, sanitary sewer rim and water valves. Caltrans as-built plans for the storm drain along Highway 49 were used for invert elevation and lateral connections. Missing rim elevations were assigned using a combination of DEM information and interpolation of ground elevations between known elevations. Missing invert elevations were assigned based on the given (or assigned) rim elevation and an assumption of three feet of ground cover above the pipe.
MOUSE MODEL
The Town of Coulterville storm drain system north of Maxwell creek is modeled as one independent urban drainage system based on an outlet point: within the drainage system are 20 catchments that add runoff, peaking at various intervals, to the pipe network. The creek & pipe network (pipes, manholes, catch basins, etc.) routes the runoff from catchments to a determined outlet point. Therefore, MOUSE models the effects on the piping network as it is being “loaded” with runoff.

Input and Output
MOUSE surface runoff calculations require two types of input data: boundary data and urban catchment data. Boundary data for the runoff computation consists of an input rainfall time series representing the design storm event for the model. Urban catchment data includes the boundaries of each drainage catchment, along with relevant physical and hydrologic parameters including surface area and basin lag time.

MOUSE pipe flow calculations require network data, operational data, and boundary data as input. Network data consists of the pipe network elements including nodes (manholes, basins, outlets, and storage nodes) and links (pipes, culverts, and open channels). Parameters required to describe nodes include the x and y coordinates of the node, unique name, node type, diameter for manholes, geometry for basins, ground and invert levels, and water levels in outlets. Parameters required to describe links include name of upstream and downstream nodes, cross-sectional shape and dimensions, material, and upstream and downstream inverts. A Manning’s n value of 0.03 was used for all channels, 0.015 for concrete pipes and 0.024 for corrugated metal pipes.

Boundary data for the pipe flow computation can include any external loading, inflow discharges, water levels at interaction points with receiving waters; as well as the results of a run-off calculation. For this study there is only one outfall location; at the Caltrans 60" RCP. A normal depth calculation for the discharge channel was used to estimate the 10-year and 100-year water surface elevation at the outfall, which are 1666.5’ and 1667.1’, respectively.
RUNOFF ESTIMATION
Methods used in this drainage study to estimate peak storm water flow rates and volumes required input of precipitation data. Since it is impossible to anticipate the effect of every conceivable storm, precipitation frequency analyses are often used to design facilities that control storm runoff. A common practice is to construct a design storm, which is a rainfall pattern used in hydrologic models to estimate surface runoff.

Precipitation frequency analyses are based on concepts of probability and statistics. Engineers generally assume that the frequency (probability) of a rainfall event is coincident with the frequency of direct storm water runoff, although runoff is determined by a number of factors (particularly antecedent moisture conditions in the basin) not necessarily dependent upon the precipitation event. For the purpose of evaluating storm drain performance for this study, both the 10-year and 100-yr design storms were used.

Design Storms
The 10-year & 100-year, 24-hour rainfall patterns were used to complete the Coulterville Storm Drainage Study obtained from an Intensity, Duration and Frequency Curve (IDF) from the Mariposa CDF gage station. The precipitation, inches, was balanced to a Type I rainfall distribution using HEC-1.

Unit Hydrographs
The SCS unit hydrograph method was the best method available using the MOUSE software during the modeling phase of this project. The SCS unit hydrograph is a standard method which is widely used for hydrologic calculations.

A unit hydrograph is a numerical representation of the time response of catchment runoff caused by one inch of excess rainfall applied uniformly over a unit of time. Many different techniques are available to estimate unit hydrographs. The SCS-dimensionless unit hydrograph was used in the Coulterville storm drain model, as shown in Figure 7.
Figure 7: SCS Dimensionless Unit Hydrograph

The SCS lag time equation provides an estimate of basin lag, which is defined as the time from the center of the unit rainfall event to the runoff peak. The SCS equation for basin lag is:

\[ T_{\text{LAG}} = L^{0.8} \frac{(S+1)^{0.7}}{1900Y} \]

where,

\[ S = \frac{1000}{CN} - 10 \]

and \( T_{\text{LAG}} \) is lag time in hours, \( L \) is the hydraulic length of watershed in feet, \( S \) is the maximum retention in the watershed in inches, \( Y \) is the average basin slope in percent, and \( CN \) is the SCS curve number for the basin.

**Infiltration and Other Losses**

Direct runoff is estimated by subtracting soil infiltration and other losses from the rate of rainfall. The Curve Number (CN) Method is an empirical methodology derived by the Soil Conservation Service (SCS) to estimate direct runoff. The method assumes an initial amount of rainfall is absorbed by tree cover, stored in depressions, and infiltrates soil before any direct overland runoff will occur. This initial surface moisture storage (IA) is calculated using the following equation:

\[ IA = 0.2 \times S \]
where S is the maximum retention in the watershed from the previous equation. For rural areas the initial abstraction is set equal to 0.05 inches.

The CN represents the storm water runoff potential in a drainage basin. Curve numbers vary from 0 to 100; with 0 equating to no runoff from a basin and 100 indicating that all precipitation will run off. The CN is estimated as a function of hydrologic soil group, land use/cover, and antecedent moisture condition (AMC), with AMC defined as the moisture content of a soil prior to any precipitation event. An AMC of two was calibrated specifically for the rainfall distribution in Figure 7. If any other storm distribution is used then the AMC value must be recalibrated. AMC is characterized by the SCS as:

- AMC I: soils are dry
- AMC II: average conditions
- AMC III: heavy rainfall, or light rainfall with low temperatures; saturated soil

Curve numbers used in the Coulterville hydrology study are based on CN tables published in the Santa Clara Valley Water District Hydrology Manual; SCS maps of established Hydrologic Soil Groups; and land use information from the Mariposa County General Plan. A table of weighted Curve Numbers used in the model for each basin is provided in Table 2. Figure 8 shows each basin in the Coulterville watershed.

Table 2: Basin Curve Number

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<th>CATCHMENT ID</th>
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<th>CATCHMENT ID</th>
<th>SCS CURVE NUMBER</th>
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DRAINAGE STANDARDS
The drainage system was analyzed for ultimate development to determine its flow conditions during the design 10-year and 100-year storm. Areas of significant flooding were recognized and improvements required for the system were determined. Network piping was increased to alleviate significant flooding. System improvements were sized for the 100-year storm.

Supporting calculation for storm drain design, as well as MOUSE results can be provided upon request.
Analysis

EXISTING SYSTEM WITHIN COULTERVILLE
The Coulterville drainage area is approximately 200 acres, and is bounded by open space to the north, east, and west. The Coulterville collection system consists of 38 nodes (manholes, inlets, etc.) and 7,755 linear feet of connecting storm drain pipes, culverts and channels.

Identified Deficiencies
MOUSE analysis of Coulterville's existing storm drain system was analyzed with both the 10-year and 100-year storms. System deficiencies are identified by flooding at nodes. The flooding depths were analyzed to help determine flooding severity. Maps of the flooding depths for both storm events are presented in Figure 8.
Figure 8: Coulterville Existing 10-Year & 100-Year Flooding Depths
PROPOSED IMPROVEMENTS FOR THE TOWN OF COULTERVILLE

Recommended improvements were developed to alleviate flooding in a 24 hour, 100-year recurrence interval storm which currently is not being provided with the existing storm drain system. The improvements proposed will not increase the total watershed for the Town of Coulterville. Additionally, improvements may require either encroachment permitting and/or hydraulic calculations submittal to Caltrans.

Recommended Improvements

The recommended improvements required to alleviate flooding during a 100-year storm events are shown in Figure 9 and in the attached drawing (24"x36"), which include a new storm drain piping down Main Street; runoff from the northeastern portion of Coulterville basin will be routed via storm drain piping within the public right of way. Improvements will begin at the culvert at the intersection of Broadway Ave. and Cemetery Rd. Runoff contained within the storm drain piping will travel down Cemetery Rd. until it reaches Main St., continue down Main St. and discharge to an existing 48” manhole near Highway 49. From this point, existing storm drain infrastructure will have the capacity to transmit all accumulated runoff to Maxwell Creek via Caltrans storm drain. Additional improvements include an inlet on Water Street to collect surface runoff and additional inlets and piping on Main St. and Broadway Ave. Park Lane also requires storm drain improvements which allows for the abandonment of existing storm drain outside the public right of way. Park Lane will also be crowned and its entire width resurfaced. All improvements to Park Lane will improve overall drainage in this area. Finally, three culverts on the south side of Maxwell Creek, which have been identified by the county, have been sized for 100-year flows using the rational method. Design was based upon existing pipe slopes and a minimum allowable head of 18”.

Improvements were designed assuming all runoff is captured within the storm drain. Assumptions were made for pipe material and slope. Placement of drop inlets should be evaluated (calculated) during design; if altered, pipe sizes should be re-evaluated.

Figure 9 shows the proposed location for future improvements, as well as, existing sanitary sewer, storm drain and water locations.

Existing sanitary sewer and potable water were located by the county survey crew; however, these locations are approximate and should be verified before design and construction.
Expected utility depth is roughly 36", Utility Service Alliance (USA) should be notified prior to construction.
COST OF IMPROVEMENTS
Costs have been estimated using information from other projects, cost estimating guides
All estimates are based on the ENR November 2007. Costs include open trenching in
roadway, 0-10 ft depth, and include connections and pavement replacement. A cost for
utility relocation was added; however, if major or numerous relocations are needed this
estimated cost will not be sufficient. A cost was added to resurface Main St. beginning at
the intersection of Highway-49 to the intersection of Cross St. The approximate distance
and width are 1440 feet and 40 feet, respectively. The approximate area for main street
resurfacing is estimated at 57,560 square feet. Table 3 summarizes the probable cost of
construction by street improvement.
Table 3: Estimate of Probable Construction Cost

PREPARED FOR MARIPOSA COUNTY
COULTERVILLE DRAINAGE STUDY
Estimate of Probable Construction Costs
July 20, 2007

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<td><strong>40% Contingency for Administrative, Legal, Permitting, and Engineering Fees</strong></td>
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**TOTAL ESTIMATED PROJECT BUDGET**

$1,192,300

This estimate of construction cost is a professional opinion, based upon past experience with the design and construction of similar projects. This is a budget level estimate, once final design is complete a more accurate quantity takeoff and estimate should be prepared. It is prepared only as a guide and is subject to changes. Schaaf & Wheeler make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or eminent domain purchase are not included in this estimate.

7/25/2007

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS