



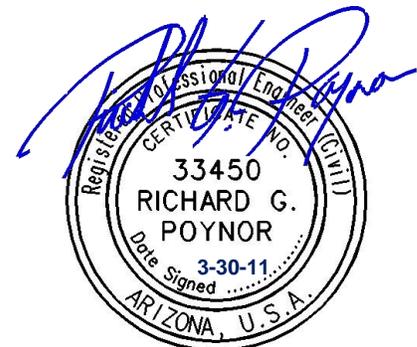
Town of Chino Valley Area Drainage Master Study



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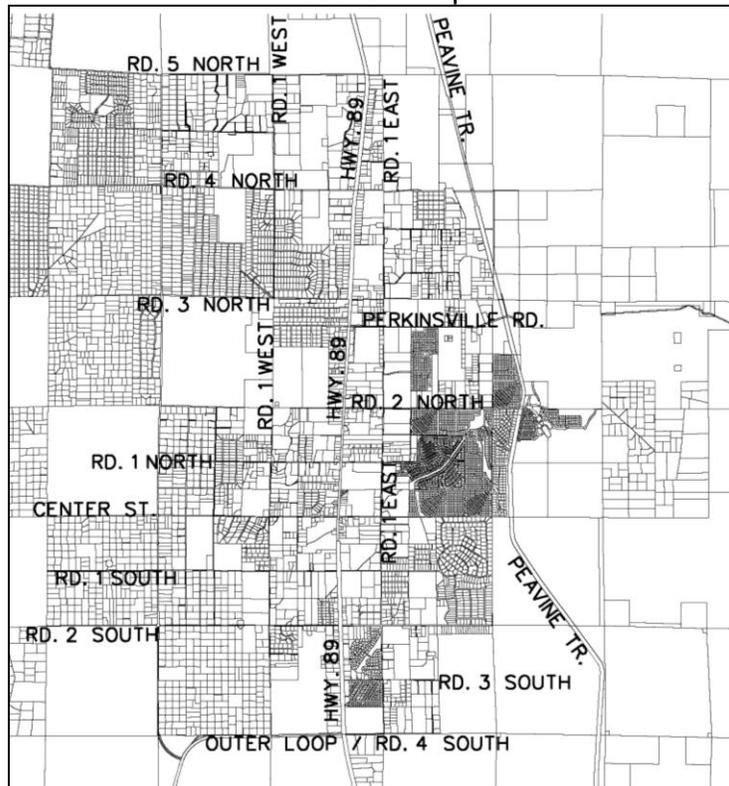
I. PROJECT LOCATION AND OVERVIEW

The Town of Chino Valley is located in northern Arizona, covering portions of Townships 15-17 North and Ranges 1-2 West of the Gila and Salt River Base & Meridian. The main areas of focus for this study are selected reaches between Outer Loop Road/Road 4 South and Road 5 North, both west and east of Highway 89. Elevations within the studied areas range between 4490 and 4840 feet above sea level. See below for vicinity and location maps.

Vicinity Map



Location Map



The purpose and scope of this Area Drainage Master Study (ADMS) is to provide the Town of Chino Valley a general overview of high recurrence flooding areas and potential future solutions within the Town selected reaches for the 100-year rainfall event. This report is not intended to be a detailed drainage analysis, but rather a general tool for the planning of future detailed studies per the request of the Town. The reaches selected for this report were dictated by Town staff and include areas throughout Chino Valley with known existing flooding problems.

Not included in scope of this project are the following:

- Field survey of existing drainage structures – locations, inverts, slopes, lengths
- Survey verification of existing topography from Cooper Aerial
- Detailed Manning's n value determinations
- Reaches detailed on effective FEMA maps
- Submittal to FEMA for revising effective maps or studies
- Recurrence intervals other than the 100-year event
- Detailed solutions or plans for problem areas throughout the Town
- Detailed cost estimates for the proposed solutions

II. FLOOD ROUTING ANALYSIS

The effective FEMA Flood Insurance Rate Maps (FIRMs) for the Town of Chino Valley are shown in Appendix A. These FIRMs only detailed the Santa Cruz Wash and the Chino Valley Stream. The results of this master study will not be submitted to FEMA, but will be used by Town staff to preliminarily determine the current and future flood hazards for specific parcels located throughout Chino Valley. The ground topography has been provided by Cooper Aerial and is only accurate to +/- half the contour interval. Different portions of the topography are at 1' instead of 2' contour intervals due to the need for more detailed topography in specific portions of the Town. For modeling, the digital terrain model (DTM) was created from the points (grid and spots) and breaklines throughout the Town, which are significantly more accurate than what the contours depict. Aerial imagery was also provided by Cooper Aerial and was flown in December of 2009.

The hydrologic modeling and drainage basins affecting Chino Valley were delineated by Civiltec Engineering, and peak flows for the basins and concentration points were computed. Lyon Engineering used the 100-year peak flows to model the hydraulics of the selected reaches. All reaches are labeled by the basin numbers through which they travel. Because peak flows are used instead of basin hydrographs, the worst-case flood limit scenario is shown for each reach. If hydrographs would have been used, basin routing, time of concentration, and infiltration characteristics might have decreased the peak flow upstream of concentration point locations. Peak flows were used as directed by Town staff.

The hydraulic and flood limit modeling in this report is for general use purposes, as directed by the Town Engineering Department. No water surface elevations are shown, and no cross-sections have been analyzed. FLO-2D software has been utilized, resulting in a very accurate representation of where drainage flows and how deep it is in the analyzed storm event. Approximate flood limits are mapped to show potential hazardous inundated areas. Further analysis will be needed on individual reaches if more detail is required. The following table identifies the FLO-2D grid sizes used for each reach identified on Exhibits 1 and 2, and in Appendix F:

Grid Size	Reach
25 Feet	206-201 212 218-211, 209, and 210 234-233-229-217 237-232-228-225-217 608-609 and 607
35 Feet	219-214-206 221-220 and 222-217 309-308-307-310-306 and 306
45 Feet	204-202 305-301-300 611-610-600, 501, and 401

Flows for modeling the reaches were distributed several ways. The flows have been determined and distributed as in the table in Appendix B. For areas near a basin outlet point, the concentration flow from *that* basin was used. For areas near the upper portion of a basin, the corresponding drainage area percent was used for *that* basin. Flows were distributed as directed by Town staff.

The Manning's n value used for all reaches is 0.040, as directed by Town staff. The majority of the areas studied have n values close to 0.040 or less. The studied flowpaths had a variety of cover and vegetation, such as soil, sand, gravel, rocks, grass, weeds, and trees. Future individual studies will require detailed analysis of the terrain and roughness specific to those areas. See Appendix C for the Army Corps of Engineer's Manning's n values table used as a reference.

Field visits were made on November 3rd and 17th, 2010 to determine the size and shape of hydraulic structures. As directed by Town staff, a detailed field survey was not completed; instead, structure sizes and cover were measured and capacities were computed using an assumed length and a 1.00% slope. See Appendix D for pictures of the structures. See Exhibits 1 and 2 for locations of the structures and the location and direction of each picture. CulvertMaster worksheet calculations were computed for each structure. See Appendix E for these calculations and resulting rating tables; the worksheets are labeled by picture number.

III. FLOOD ROUTING RESULTS

Approximate 100-year flooding limits for all reaches are shown in the color 11"x17" exhibits with aerials in Appendix F. These exhibits show depth of flooding greater than 0.25' (3") with the exception of Sheet 3, which shows depth of flooding greater than 0.0'. The Town requested that Sheet 3 be the one exception to the flood depth due to the relative shallow flow through non-channelized areas. Utilizing the 0.25' flood depth causes some flow areas to appear as broken ponded areas or depressions. This is a result of areas that are flooded by greater than 0.25' but surrounded by areas of flooding less than 0.25'.

The Master Flood Routing Exhibits overlays the flood areas examined onto the aerial mapping, basin map, roadways, and topography. The flooding limits are shaded a consistent color of blue to represent the 100-year flood limits in the reaches studied. The FEMA detailed studies are also shown on these exhibits in red as a reference, even though they are not a part of this report modeling. These exhibits are 1" = 800' scale and represent the approximate flooding limits of the 100-year storm.

IV. REGIONAL PROJECT RECOMMENDATIONS

Town staff chose 10 locations within the ADMS for potential future drainage projects. Refer to Exhibits 1 and 2 for the project numbers and locations. The projects chosen were based upon areas of high flow, available open space/undeveloped land, and the necessity to reduce flooding problems. Projects chosen for future drainage improvements will require detailed drainage analysis including volumes, routing, structure design, and construction plans.

To help the Town decide which drainage projects may be pursued in the future, a priority matrix has been put together for staff reference. The matrix and associated cost estimates are located in Appendix G. The matrix priorities were assessed using the following categories:

Category	Description
A	Estimated construction cost
B	Number of homes/businesses helped
C	Number of properties to be impacted by land/right-of-way acquisition
D	Recurring complaints
E	Recurring Town maintenance
F	Recurring access problems

Scoring for the matrix was determined by using set ranges on a 10 point scale for each category as determined by Lyon Engineering and Town staff. See Appendix G. With six categories, the highest score possible is 60 points. For Category A, cost ranges were utilized to establish an equivalent score. Category B has a scoring range based on the number of homes or businesses that would benefit from drainage improvements.

Category C has a scoring range based on the number of properties that would be impacted by land acquisition. Categories D thru F were ranked as either, “High”, “Medium”, or “Low” by Town staff to produce a relative score.

The following 10 projects were chosen by Town staff and include a preliminary design concept for a drainage solution and/or mitigation of the existing drainage problem:

1. Perkinsville Road at the Santa Cruz Wash

Drainage Problem: The small size of existing drainage structures causes water to back up behind Perkinsville Road and overtop during large storm events.

Solution/Mitigation: Conduct grading and install erosion protection within Santa Cruz Wash north and south of Perkinsville Road. Install several box culverts to increase discharge capacity under Perkinsville Road. Provide engineering for a CLOMR and LOMR submittal for approval by FEMA.

2. Cemetery Draw at Juniper Drive

Drainage Problem: Existing homes and roads are frequently flooded during large storm events from Cemetery Draw. There is no existing channelization or infrastructure for the Draw. There is frequent, on-going maintenance and clean-up after storm events by Town staff.

Solution/Mitigation: Install a retention pond with drywells and a controlled outlet structure near the northwest corner of the Highlands Ranch subdivision, requiring the acquisition of land for regional pond use. Outlet structure would convey to a new large culvert due east down Juniper drive to its terminus at the Santa Cruz Wash. A FEMA CLOMR and LOMR would most likely be required. Flooding conditions would greatly improve for many homes north of Juniper Drive. This would also reduce the Town maintenance for the surrounding residences and roadways.

3. Chino Meadows Unit 5 at Peavine Trail

Drainage Problem: Chino Meadows Unit 5 is heavily impacted by drainage passing under and in some cases, over the Peavine Trail affecting multiple homes and roadways. Existing channels are undersized and heavily eroded.

Solution/Mitigation: Install a series of retention/detention ponds with drywells and a controlled outlet structure on the east side of the Peavine Trail to reduce flow through Chino Meadows Unit 5 and redirect flow to the north to a more confined channel. Improve the existing channel from the Peavine trail box culvert outlet down to the Santa Cruz Wash.

4. Road 3 North at Town Hall

Drainage Problem: Current drainage structures under Road 3 North and the outlet channel are undersized for the existing drainage condition. There are multiple complaints and access problems during large storm events.

Solution/Mitigation: Analysis of the existing retention pond just south of Road 3 North would be required to determine if it has adequate capacity. A new outlet would be constructed for the existing pond utilizing box culverts under Road 3 North, and a large channel to connect to the existing channel within Appaloosa Meadows. The box culverts under Road 3 North have already been purchased and delivered to the Town. They are eight, pre-fabricated box sections with bases, each measuring 10' long, 8' wide and 4' high. The proposed channel will most likely require land acquisition. Drywells would be installed to empty the pond after storm events.

5. Mariposa Manner Unit 2 South Boundary

Drainage Problem: Existing homes and roadways are impacted by large storm events as it sheet flows through Mariposa Manner Unit 2. There is no existing channelization or infrastructure for the sheet flow interception. There is frequent, on-going maintenance and clean-up after storm events by Town staff.

Solution/Mitigation: Install a retention pond with drywells south of the subdivision boundary on private land. This property is undeveloped, and land would need to be acquired for this regional pond.

6. Road 2 South West of Highway 89

Drainage Problem: Drainage backwater frequently floods the business parcel to the west of the Maverick gas station and pools at a low point on Road 2 South just west of Hwy 89. Road closure is a frequent problem at this location.

Solution/Mitigation: Install a large catch basin west of the Maverick, a grate structure across Road 2 South, and connecting storm drain to direct drainage to the ADOT right-of-way and existing structures. Adjacent to Highway 89, the existing channel will be extended or widened accordingly.

7. Road 1 South from West of Road 1 East to Santa Cruz Wash

Drainage Problem: The small size of existing drainage structure causes water to back up behind Road 1 South and overtop during large storm events. This occurs at multiple locations impacting several homes and causing frequent road closures.

Solution/Mitigation: Install a retention pond with drywells and a controlled outlet structure and convey storm water east through a new large culvert in Road 1 South to an additional regional retention/detention pond on County-owned land. Right of Way and land acquisition will be necessary from landowners as well as the County. A possible increase in flow to the Santa Cruz Wash will require a FEMA CLOMR and LOMR. Drywells would be installed to empty the pond after storm events.

8. Center Street West of Road 1 East

Drainage Problem: The current drainage structures under Center Street and Road 1 East are undersized for the existing drainage condition. Flow frequently tops Center Street inundating two private parcels and then crosses over Road 1 East. Road closures are frequent during large storm events.

Solution/Mitigation: Install large culverts under Center Street and Road 1 East with a connecting large channel between them. From Road 1 East, install a defined drainage channel along the existing flow path to its terminus at the Santa Cruz Wash. Land acquisition will be required from parcel owners.

9. Road 2 South Crossing East of Road 1 East

Drainage Problem: Current drainage structure under Road 2 South is undersized for the existing drainage condition. Flow passes over Road 2 South during a medium sized storm event and impacts an existing home lying directly in the discharge path. Road closures are frequent during large storm events.

Solution/Mitigation: Install a retention pond with drywells on the south side of Road 2 South. Land acquisition will be required for the pond and a potential small home purchase.

10. Perkinsville Road East of Road 1 East

Drainage Problem: The current Perkinsville Road drainage channel and structures cannot convey the existing drainage condition. Homes and business are impacted by drainage flows backing up behind Perkinsville Road and as it overtops the roadway.

Solution/Mitigation: Install a retention pond with drywells and a controlled outlet structure and convey storm water east through a new large culvert on the south side of Perkinsville Road to capture flow before it impacts the roadway. Install roadway improvements such as curb and gutter and catch basins where necessary. The pond would be installed on Town property and would not require land acquisition.

V. CONCLUSIONS

This report is an approximate determination of flood limits for the selected reaches, based on the topography provided by Cooper Aerial and using basins and peak flows provided by Civiltec Engineering. The purpose and scope of this ADMS is to provide to the Town of Chino Valley an overview of flooding problems and potential future solutions within the selected reaches for the 100-year event. This report is also for the planning of future detailed studies within the selected reaches.

The priority matrix ranks Projects #2, #3, and #6, respectively, as the top three projects to be first considered for detailed design and eventual construction. This matrix should not be considered the final decision for a projects importance or its time frame for construction. For example, a higher scoring project may not be the best alternative for the Town based on the cost to construct that project. However, funds may be available for a lower scoring project, though it helps fewer residences. Therefore, the matrix should be considered a tool for project discussion only. Time frames, fund availability, and impact to the residents of Chino Valley would ultimately be the deciding factors. Refer to the following table for a summary of the conclusions of the priority matrix:

Project Ranking	Total Score	Project Number	Project Description
1	54	2	Cemetery Draw at Juniper Drive
2	48	3	Chino Meadows Unit 5 at Peavine Trail
3	46	6	Road 2S West of Highway 89
4	37	5	Mariposa Manner Unit 2 South Boundary
5	35	4	Road 3N at Town Hall
6	30	9	Road 2S Crossing East of Road 1E
7	29	7	Road 1S from West of Road 1E to Santa Cruz Wash
8	24	1	Perkinsville Road at the Santa Cruz Wash
9	23	8	Center Street West of Road 1E
10	16	10	Perkinsville Road East of Road 1E

VI. REFERENCES

Civiltec Engineering, Chino Valley Area Drainage Master Study, Hydrology Report, Basins and 100-Year Peak Flows

Federal Emergency Management Agency, Flood Maps Online: Yavapai County Arizona, 2010.

Flood Control District of Yavapai County, 2005 Yavapai County Drainage Criteria Manual: Prescott, AZ.

Yavapai County – Interactive Mapping Application, Copyright © 2010, Yavapai County, AZ - YAVGIS

VII. SOFTWARE USED

Bentley's CulvertMaster™ Version 3.0 for Windows

Bentley's FlowMaster® PE Version 6.1 for Windows

Bentley's MicroStation Version 8.5

FLO-2D Flood Routing Model Version 2009