Town of Oro Valley
Department of Public Works

Drainage Criteria Manual

2010 Edition

Town of Oro Valley
Department of Public Works
11000 N. La Cañada Drive
Oro Valley, Arizona 85737
(520) 229-4800 Fax: (520) 229-4899

Feb 01, 2010

Dear User:

The attached Town of Oro Valley Drainage Criteria Manual is the current 2010 edition which is a revised version of the original 2002 manual. This revision was prepared by DMA Engineering, LLC and the Town of Oro Valley Department of Public Works staff. Use of the guidance and requirements in this manual shall be mandatory for all new public and private projects, including retrofits of existing developments/facilities submitted on or after February 1, 2010. This manual shall be used for the preparation and submittal of hydrologic and hydraulic reports to the Town of Oro Valley Department of Public Works, and for the design of drainage and storm water management facilities in the Town of Oro Valley.

Every effort was made to ensure this document is free of discrepancies or errors. However, if you believe you have found a discrepancy or error, please advise this Department in writing at:

Town of Oro Valley Department of Public Works

11000 N. La Cañada Drive

Oro Valley, Arizona 85737

Department of Public Works

Attention: Paul Keesler, P.E.

This manual will be updated as needed to reflect additional experience, new technology or changes in storm water related regulations. It shall be the users' responsibility to ensure that they are using the most recent edition of this manual. Any changes will be posted on the Towns website: (www.orovalleyaz.gov/Town_Government/Public_Works.htm) Recent changes and updates shall be highlighted with a grey background behind the affected text.

Sincerely,

Mr. Craig Civalier, P.E.

Town Engineer

Acknowledgements

2010 Edition/Revisions

650 W Linda Vista Blvd.

Oro Valley, Arizona 85704

2002 Edition

7600 N.15th Street, Suite 250

Phoenix, Arizona 85020

List of Figures and Tables

1. INTRODUCTION

Use of this Drainage Criteria Manual (DCM) is mandatory for all projects submitted on or after February 1, 2010. This Manual shall be used for the preparation and submittal of all Hydrologic and Hydraulic Reports and Statements, and for the design of drainage and storm water management facilities within the Town of Oro Valley, Arizona.

The purpose of this Drainage Criteria Manual is to guide Engineers, Hydrologists and other professionals in the location, sizing and design of drainage and storm water management facilities within the Town of Oro Valley, Arizona. The design professional's judgment and creativity shall supplement the content, context, intent and references of this Manual.

Standards, accepted methodologies and design references are identified throughout this Manual. When encountering issues not specifically addressed and/or referenced herein, the user is directed to apply the most current version of City of Tucson's "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona". It is neither the intent of the Town nor the purpose of this manual to duplicate the standards, references, or methodologies noted therein. The Town Engineer understands that by virtue of Oro Valley's natural environment and because of Town Ordinances, Standards, Policies, etc. there may be a need to use methods and applications that differ from the accepted design references. The Town may accept these methods, provided prior written approval is granted by the Town Engineer. To gain pre-approval, documentation sufficient to satisfy the Town Engineer must be submitted to the Department of Public Works for consideration. Allow a minimum of 30 days for review and formal reply.

Ultimately the design professional shall be responsible for all the information contained within any plan, report or technical memorandum submitted to the Town. All information submitted to the Town for review shall be substantiated by research and calculation. This includes any information based upon the results of the "Town Wide Drainage Study". The information contained within the Town Wide Drainage Study should be utilized as a guide for comparison of watershed areas, runoff values and input parameters only and not the basis of hydrologic calculation for submittal.

In addition to the standards, accepted methodologies and design references noted herein, specific factors of safety are to be applied as follows:

Culverts not under pressure flow:
Increase by one culvert size or increase by one barrel when $d \geq 0.8\ D$ (or culvert rise for other than circular cross-sections).
Where: d = flow depth
D = Culvert Diameter or Culvert Height in non-circular sections

Catch basin and other inlet factors of safety:
As described in the City of Tucson's "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona".

Clogging Factor of Safety:
As described in the City of Tucson's "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona".

Open channels:
Total channel depth to include required freeboard plus sediment load, if aggradation is predicted.

Detention Basins:
Increase basin volume to include sediment volume resulting from 2-year storm (minimum).

In cases where this Manual is in conflict with noted standards, accepted methodologies and design references, this Manual shall govern unless otherwise approved in writing by the Town Engineer.

This Manual will be updated and modified as needed to reflect additional experiences, new technologies and/or changes in storm water-related regulations and policies. It shall be the responsibility of the user to ensure they use the most current edition of this Manual.

Every effort was made to ensure this document is free of discrepancies and errors. However, if the user believes they have found a discrepancy or error, and for additional information please contact:

Town Engineer's Office
Town of Oro Valley
1100 N. La Cañada Drive
Oro Valley, AZ 85737
(520) 229-4800

Updated February 2010

2. DRAINAGE REPORT FORMAT, PROCEDURES AND SUBMITTAL REQUIREMENTS

2.1 Introduction

The purpose of this section is to set a level of standardization for drainage reports and hydrologic study submittals. Designers shall employ the following formats and content requirements for all rezoning, PAD amendments, development plans and preliminary plats.

2.2 General Drainage Report Format for Rezoning and PAD Amendments

Included within every Site Analysis Report submitted to the Town of Oro Valley for rezoning and PAD amendments shall be drainage information addressing both Part I – Inventory and Analysis as well as Part II – Land Use Proposal. Content of the drainage sections will vary with the complexity of the Site Analysis Report, but the content of the report shall include at a minimum the following:

2.2.1 Part I – Inventory and Analysis

1. Describe and map on an aerial photograph the perimeter of all off-site watersheds that affect, or are affected by, the site both upstream and downstream to their logical conclusion and note all balanced and critical basins.

2. Provide a description of any significant off-site natural features and manmade features located within the above watersheds that may affect or be affected by the site.

3. Indicate the area in acres for those upstream off-site watersheds with 100 year discharges greater than 50 cubic feet per second (cfs).

4. Describe and map the characteristics of the existing on-site hydrology. Include the following:

    a. Approximate 100 year flood floodplains with a discharge greater than or equal to 50 cfs.

    b. Sheet flooding areas with their average depths

    c. Federally mapped floodway and floodplains

d. Peak discharges both entering and leaving the site for 100 year events which exceed 50 cfs using approximate methods such as the regional area versus discharge graphs.

5. Provide a qualitative description of existing drainage conditions along the downstream property boundary.

2.2.2 Part II – Land Use Proposal

1. Describe how the Tentative Development Plan responds to the hydrologic characteristics described in the Inventory and Analysis for both existing and proposed conditions. (Examples include building setbacks, density, building placement, location of open space and recreation areas).

2. Identify if any features of the development (i.e. structures, roads, lots), as shown by the Tentative Development Plan overlay, that encroach on and/or modify existing site drainage patterns. Explain why this is necessary and show other alternatives that have been considered.

3. Describe and map potential drainage impacts to off-site land uses both upstream and downstream due to the proposed development.

4. Describe and map approximate location of engineering and design features that will be used to mitigate drainage and erosion problems for the proposed development. (Examples include detention basins, revegetation, rip-rapping and preservation of channels in their natural state). Include appropriate details of design and methods of construction.

5. Describe how the Tentative Development Plan conforms to all applicable area plans, basin management plans and Town policies.

2.3 Drainage Delineation Requirements on Tentative Development Plans

The following drainage information shall be delineated on every Tentative Development Plan submitted to the Town of Oro Valley for rezoning and PAD amendments:

1. 100 year floodplains with a discharge greater than or equal to 50 cfs for both pre and post developed conditions.
2. Sheet flooding areas with flood depths greater than or equal to 1-foot for both pre and post developed conditions.
3. Federally mapped floodway and floodplains.
4. Indicate proposed drainage plan including drainage mitigation features.

2.4 General Drainage Report Format for Development Plans And Preliminary Plats

Content of the drainage report will vary with the complexity of the development and corresponding study, but the format of the report shall follow the outline below. The following checklist*, with completed items checked*, is to be included with each drainage report submittal to the Town. **Omitting the checklist may result in the report not being reviewed and/or accepted**. For areas that are non-applicable, the submitter should indicate N/A along with a brief explanation.

2.4.1 Drainage Report Format/Checklist

Cover:

- ❑ Name, address, Township, Range, Section and Pima County Tax ID Code of the parcel, project or development for which the report is being submitted, as well as the Town of Oro Valley project number.
- ❑ Name and address of the client/owner of the parcel.
- ❑ Name and address of the engineering/consulting firm preparing the report.
- ❑ Submittal date.
- ❑ Name of person preparing the report, if other than registrant sealing the report.
- ❑ Seal and signature of Arizona Registered Professional Engineer meeting AZBTR specifications and requirements. (and/or on the table of contents)

Table of Contents:

- ❑ Seal and signature of Arizona Registered Professional Engineer (and/or on the report cover)

1. Introduction:

- ❑ Project name and legal description.
- ❑ Vicinity Map.
- ❑ Include site location map identifying major features.
- ❑ Describe project type and size.
- ❑ Identify purpose and objectives of report (i.e. tentative plat, preliminary plat, development plan, etc.).
- ❑ Identify major drainage ways and existing drainage structures.

- ❑ Include general discussion on the topography and discuss in general the type of overland flow through the project site (i.e.: sheet flow, channelized flow etc…)

- ❑ Identify the zoning for the parcel and the zoning for parcels directly adjacent to the site.

- ❑ State whether the project site contains any Federal floodplains.

- ❑ State whether detention is required.

- ❑ State sources of other reports used for the study. These shall be included in the bibliography.

- ❑ Provide a comprehensive narrative that clearly states the drainage engineer's concepts, rationale, and assumptions. Include a discussion on the type of hydraulic and hydrologic models or analytical methods that will be used.

2. Existing Conditions Drainage:

- ❑ On-site drainage.

  i. Identify existing drainage network, patterns, watershed, and regulatory floodplain boundaries, local and Federal.

     Note: local floodplain boundaries include those associated with 100-year flows of 50 cubic feet per second (cfs) or greater.

- ❑ Off-site drainage.

  i. Note existing and future conditions, and drainage network entering the project site. Note any sheet flow conditions entering site.

  ii. Identify existing regulatory floodplain boundaries as identified by the Town of Oro Valley (local floodplain) and/or FEMA (Federal floodplain) (Include a copy of the FIRM panel or applicable portion of the FIRM panel).

  iii. Provide discussion describing contributing offsite watersheds and regulatory floodplain boundaries, Federal and local.

  iv. Identify existing drainage studies for adjacent project sites or adjacent parcels that are impacted by or that impact the proposed project site. If a drainage study is not available for an adjacent site, provide an analysis indicating the degree of impacts.

3. Proposed Conditions Drainage Design

- ❑ Include general description of proposed conditions, drainage facilities, and components.

- ❑ State storm water detention requirements for the proposed site as well as volume required, size and location of detention basins.

- ❑ Delineate pre-developed and post-developed runoff characteristics at concentration points exiting the site. While cumulative values for runoff exiting the proposed site at several concentration points may adhere to critical basin criteria, variation of runoff values at individual concentration points shall be addressed in the report. Variations in runoff at individual concentration points often impact individuals and/or small groups of property owners.

- ❑ Identify, in detail, proposed drainage structures or drainage facilities. Include design criteria and probable effects on the existing upstream and downstream drainage system.

- ❑ Identify and describe in detail first flush measures. Include design criteria.

4. Special Conditions:

- ❑ Identify and discuss any special conditions that may require deviation from standard procedures and submittal requirements as presented in this DCM and/or the City of Tucson Drainage Manual. Special conditions may imply design exceptions, stipulations and permit issues (NPDES, FEMA), etc.

- ❑ Example Permits

- ❑ State – AZPDES Notice of Intent (NOI), Notice of Termination (NOT)

- ❑ Pima County – For flows of 3,000 cfs or greater

- ❑ Oro Valley – Floodplain Use, Grading, etc.

5. Hydrologic and Hydraulic Analysis:

- ❑ Hydrology
  i. Identify and discuss in detail procedures, methods and assumptions used for hydrologic analysis.
  ii. Include summary tables listing input parameters used in the analysis and the results of the analysis.

- ❑ Hydraulics
  i. Identify and describe, in detail, procedures, methods and assumptions (with justification) used for all hydraulic conveyances analyzed, both onsite and offsite. Provide all formulae, coefficients, factors of safety applied, references, etc., applied to hydraulic computations.
  ii. Include a summary table listing hydraulic conveyances (channels, culverts, weirs, etc.) that were analyzed with a comparison of upstream and downstream pre-developed verses post-developed peak discharges, concentration points, water surface elevations, free board and velocities.
  iii. Provide standard detail number and/or regulatory agency for each standard detail referenced.

iv. Include a statement that all-weather access to habitable structures is achievable provided that all recommendations are followed. Provide a project grading figure which illustrates finished floor elevations; 100-year water surface elevations upstream, adjacent to and downstream of each habitable structure for each channel, sub-basin, structure, street, PAAL, etc. which conveys and/or ponds flows;

v. Provide a scour analysis that is commensurate with the anticipated degree of scour. This may be as simple as a determination of sufficient toe–down requirements.

- ❑ Floodplain Analysis

  i. Describe the results of floodplain hydraulic analysis in terms of site design.

  ii. Include method of floodplain boundary analysis and explain output messages and how coefficients were determined.

  iii. When mapping the results of the floodplain analysis, ensure that there is consistency between chosen hydraulic cross-sections, topography and the floodplain boundary delineation. Provide the highest possible degree of resolution when interpolating between contour intervals.

- ❑ Storm Water Detention Calculations

  i. Identify procedures, methods and assumptions. Indicate details of the methodology used such as storage/discharge or stage/discharge. Show how overflow conditions are addressed. Show how basin is drained completely, no water retained.

  ii. Include Table of Volume of Storage required, and Location and Storage Volume required

  iii. Include Tables for detention basins at the 2, 10, 50 and 100 year frequency events. Also include graphic hydrographs of the mitigation achieved by the detention basin.

- ❑ Drainage Structures Design

  i. Identify procedures, methods and assumptions used for design of storm drains, culverts, etc.

  ii. Include a summary table of drainage structures and flow values associated with structures.

- ❑ Erosion Control

  i. Discuss procedures, methods and assumptions.

  ii. Include discussion of Storm Water Pollution Prevention Plan submittal requirements.

  iii. Discuss the need for bank protection, the proposed location, materials and freeboard.

  iv. Discuss scour basin requirements, dimensions, and materials.

v. Discuss and calculate the erosion hazard zone setback (ERZ)

- ❑ Storm Water Quality and Quantity
  i. Discuss first flush measures utilized and provide manufacturer's specification literature and/or supporting calculations.
  ii. Discuss water harvesting measures that are utilized and ensure code compliance.
  iii. Calculate the total impervious area of the development for future use in determining storm water fee. This calculation is not required for developments consisting of single family detached or two family residential subdivisions.

6. Conclusions and Recommendations:

- ❑ Discuss overall project objectives.
- ❑ Affirm compliance with criteria set forth in this Manual and other Town of Oro Valley Standards.
- ❑ Discuss the influence of proposed development on existing conditions.
- ❑ Discuss the effectiveness of the drainage design to control damage from storm water downstream and upstream of project site.
- ❑ Discuss impacts to adjacent properties and watershed drainage.
- ❑ Discuss if and how drainage improvements will be phased.
- ❑ Provide a summary of report's findings.
- ❑ Provide detailed recommendations for, at a minimum:
  i. providing all-weather access to all proposed habitable structures
  ii. maintaining upstream and downstream water surface elevations and channel equilibria
  iii. providing required detention
  iv. first flush and water harvesting
  v. maintenance requirements for basin and hydraulic structures
  vi. erosion hazard setbacks

7. References:

- ❑ List all references used.

Appendix A – Hydrologic Computations and Backup

- ❑ Include land use assumptions, existing and proposed.
- ❑ Include soils information and exhibits.
- ❑ Include peak flow calculations.
- ❑ Include detention inflow-outflow analysis and basin design calculations.
- ❑ Include computer input and output files in both hard copy and electronic format.
- ❑ Include electronic copies (AutoCAD/GIS) of basin delineations, flow paths, routing reaches, concentration points, and other supporting hydrologic data.

Appendix B – Hydraulic Computations and Backup

- ❑ Include channel design calculations.
- ❑ Include floodplain calculations and encroachment analyses. At a minimum, include assumptions, input/output data, cross-section number, water surface elevations, coefficients applied, top width, area, velocity, and Froude number. Clearly delineate existing/proposed floodplain limits and indicate existing/proposed water surface elevations.
- ❑ Cross-section and profile plots.
- ❑ Include erosion hazard setback calculations.
- ❑ Include culvert design calculations. Provide centerline profile of culvert structure indicating, at a minimum:

  i. existing and proposed ground,

  ii. existing and proposed HGL,

  iii. backwater conditions,

  iv. flowline and soffit of culvert,

  v. headwater and tailwater elevations,

  vi. inlet and outlet structures, and

  vii. Inlet and outlet scour protection measures. Water surface profile is to extend from upstream to downstream flow continuation points.

- ❑ Include curb opening and catch basin calculations.

- ❑ Include storm drain calculations. Provide centerline profile of storm drain structure indicating, at a minimum:

  i. existing and proposed ground,

  ii. existing and proposed Hydraulic Grade Line (HGL)/ Energy Grade Line (EGL),

  iii. flowline and soffit of storm drain, manholes, junctions, headwater and tailwater elevations,

  iv. inlet and outlet structures, and

  v. Inlet and outlet scour protection measures. Water surface profile is to extend from upstream to downstream flow continuation points.

- ❑ Include sediment and scour calculations.

- ❑ Include rip-rap sizing and stability analysis.

- ❑ Include finished floor elevations.

  i. Basis for setting finished floor elevations for floodplains and/or adjacent washes.

- ❑ Include computer input and output files in both hard copy and electronic format.

- ❑ Include electronic copies (AutoCAD/GIS) of floodplain delineations, cross section locations and 100 year water surface elevations.

Appendix C – Plans, Maps and Figures

- ❑ Include applicable plan set/sheets related to drainage activities and design.

- ❑ Include an Offsite Existing Conditions Watershed Map. This map is to be to scale, 24" x 36" plan sheet minimum, and shall delineate and illustrate, at a minimum:

  i. north arrow

  ii. Scale – as appropriate to fit in one exhibit

  iii. topography and contour interval (if available)

  iv. project site boundary

  v. $Q_{100's}$ entering and exiting the site with accompanying drainage area in acres (or square miles, as applicable) and drainage area designation as identified on hydrologic computation sheets

  vi. labeled 100-year floodplain limits for all $Q_{100} \geq 50$ cfs within 100-feet of the site boundary. Delineated floodplain limits are to include cross-sections

identified by number as indicated on hydraulic computation sheets, and 100-year water surface elevation. All existing drainage structures which may affect or be affected by the project are to be clearly identified

- ❑ Include an Onsite Existing Conditions Watershed Map. This map is to be to scale, 24" x 36" plan sheet minimum, and shall delineate and illustrate, at a minimum:

  i. north arrow

  ii. scale

  iii. topography and contour interval

  iv. site boundary

  v. $Q_{100's}$ with accompanying drainage area in acres and drainage area designation as identified on hydrologic computation sheets

  vi. labeled 100-year floodplain limits for all $Q_{100} \geq 50$ cfs. Delineated floodplain limits are to include cross-sections identified by number as indicated on hydraulic computation sheets, and 100-year water surface elevation. All existing drainage structures are to be clearly identified.

- ❑ Include an Onsite Developed Conditions Watershed Map. This map is to be to scale 24" x 36" plan sheet minimum, and shall delineate and illustrate, at a minimum:

  i. north arrow

  ii. scale

  iii. topography and contour interval

  iv. development improvements as depicted on the development plan or preliminary plat.

  v. developed and existing $Q_{100's}$ entering and exiting the site with accompanying drainage area in acres and drainage area designation as identified on hydrologic computation sheets

  vi. labeled 100-year floodplain limits, including encroachments for all $Q_{100} \geq 50$ cfs onsite and within 100-feet of the site boundary. Delineated floodplain limits are to include cross-sections identified by number as indicated on hydraulic computation sheets, and 100-year water surface elevation.

  vii. For onsite flows carried within streets and parking areas, include flow arrows sufficient to illustrate drainage patterns with Q_{100} and drainage area

designation as identified on hydrologic computation sheets, within the streets and parking areas and at point of entry and point of discharge.

viii. All proposed drainage structures are to be clearly identified. Ten-year ponding limits with regard to dry-free lane requirements are to be delineated and clearly labeled.

ix. Regulatory erosion hazard setbacks are to be clearly delineated and labeled.

x. All other information as may be required by the Oro Valley Floodplain and Erosion Hazard Management Ordinance.

2.5 Drainage Delineation Requirements on Development Plans & Preliminary Plats

The following minimum drainage information shall be delineated on every Development Plan and Preliminary Plat submitted to the Town of Oro Valley for review:

1. 100 year floodplains with a discharge greater than or equal to 50 cfs
2. Sheet flooding areas with flood depths greater than or equal to 1foot for post developed condition
3. Federally mapped floodways and floodplains
4. Proposed drainage plan including drainage and erosion mitigation features/structures, flow arrows, lot drainage pattern type and grading breakpoints.
5. All main and sub watershed boundaries with corresponding grading information.
6. Erosion Hazard Zone setback boundaries
7. Depth of flow in all channels, depth of inlet headwater for all drainage structures
8. Depth and extent of ponding in detention basins.
9. Depth and extent of ponding in water harvesting areas.
10. Pre and post developed 100 year flow quantities (Q_{100}) at all drainage structure inlet points, entering and leaving across the site property lines, within all channels and at basin outlet(s).
11. Placement and type of first flush drainage pollutant mitigation features/structures.
12. Placement of safety and barricading structures/measures as well as maintenance access features.
13. Demonstrate that both International Residential Code (IRC) and International Building Code (IBC) drainage section requirements are being met by spot elevations, drainage typical details, flow arrows, falling slope away from building and local channel placement with corresponding slope(s).

2.6 Drainage Delineation Requirements on Final Plats

The following minimum drainage information shall be delineated on every Final Plat submitted to the Town of Oro Valley for review:

1. All regulatory floodplain boundaries shall be delineated by surveyable metes and bounds, and tied to the same monumentation and horizontal control as the property lines depicted on the plat.
2. All existing and proposed drainage easements shall be delineated by surveyable metes and bounds and tied to the same monumentation and horizontal control as the property lines depicted on the plat.

2.7 Other Hydrologic/Hydraulic Documents

Other types of hydrologic / hydraulic documentations that might be submitted for review include:

1. Drainage/Hydrologic Statement a short 1-3 page document prepared by a Registered Professional Civil Engineer or Hydrologist, discussing minor drainage issues or as a revision to a previously prepared report.

2. Master Drainage Study which is a comprehensive study for a master plan community or phased development.

3. Drainage Addenda shall have a cover letter or discussion which references the original drainage report and provides additional hydrologic or hydraulic information for that report. All addendums shall be bound to the final hydrology report prior to final acceptance of project construction and release of assurances and/or bonds.

3. HYDROLOGY

3.1 Criteria

The determination of flood hydrology for designing stormwater facilities in the Town of Oro Valley is to be performed according to the procedures set forth in this Manual. Deviations from the procedures outlined in this Manual require prior approval from the Town Engineer before proceeding with the determination of design hydrology.

Table 3-1: Hydrology Design Criteria

Approach	*Parameter*	*Method*	*Comment*
Rational Equation	Rainfall, Time of Concentration (TC), C value	See Section 3.3 of this manual Refer to ADOT Hydrology Chapter 2 for further details and clarification	The Rational Equation is limited to drainage areas of no larger than 100 acres. Oro Valley is in ADOT Zone 8. * Use of PC-HYDRO program. This was developed for Pima County Regional Flood Control District (see note on PC HYDRO following this table)
Rainfall Runoff Model (HEC-1/HEC-HMS)	Rainfall	3-Hour Oro Valley Storm 24-Hour Type 1	Local storm used on watersheds smaller than 10 square miles. General storm used on watersheds between 20-100 square miles in size. For watersheds of 10-20 square miles, compare 3-hour and 24-hour results to ADOT Regression Curves.
	Loss Rate	Green & Ampt Initial & Uniform	ADOT Chapter 3
	Time of Concentration	ADOT	ADOT 4-1,4-2,4-3
	Unit Hydrograph	Clark	ADOT Section 4.2.1
	Channel Routing	Normal Depth	ADOT Chapter 5 Kinematic wave within curb and gutter street sections may be used. Other routing methods will be considered by the Town Engineer.
	Storage Routing	Handled in HEC Model	ADOT Chapter 6 Use of low-level outlet option (SL Record) only allowed if outlet-rating curve is substantiated by an external calculation.
	Transmission Losses	NA	Will only be considered for large watercourses with data substantiating the transmission loss (e.g. stream gauge data, or other scientific instrumentation).

Note on PC HYDRO: PC-HYDRO is an analytical program prepared for Pima County Regional Flood Control District. PC-HYDRO calculates rainfall runoff using an expanded form of the Rational Equation. When using PC-HYDRO, rainfall precipitation depth data shall be determined from the Town of Oro Valley site specific I-D-F curve (Figure 3-3) instead of the NOAA Atlas 14 data.

3.2 Introduction

While developing this Manual, the Town reviewed a number of hydrology methods with special attention given to methods currently used within the Tucson area. As such, the Town of Oro Valley sought the use of a method that is physically based and that is generally available and supported within the region. The Hydrology Manual of the Arizona Department of Transportation (ADOT) meets both of these objectives. This manual, although utilizing slightly different input parameters, follows the ADOT methodology. For additional explanation or determination of input parameters not presented within this manual, please refer to ADOT's Highway Drainage Design Manual – Hydrology, FHWA-AZ93-281 for details.

Based on applications of these methods to watersheds impacting the Town, reasonable results were developed that compared well with ADOT Regional Regression estimates and published flood insurance data. Parameters were selected utilizing methods described by ADOT and the Flood Control District of Maricopa County. For purposes of making recommendations for this manual, four storms were evaluated for input to the model. These included Type I and Type II 24-hour storms, and the Tucson and Oro Valley 3-hour storms.

In certain circumstances, the Oro Valley site specific rainfall values are in close agreement with the ADOT Regression Curves, thus validating the concern related to how the rainfall is positioned in time when applied to a rainfall runoff model. Therefore the Oro Valley 3-Hour storm method shall be utilized for all watersheds smaller than 10 square miles.

In evaluating larger watersheds, the Type I and Type II Rainfall Methods, developed by the USDA Natural Resource Conservation Service (SCS) for use in hydrologic modeling, were utilized. Although the Type II storm is recommended for most other regions of the U.S. including Oro Valley and the Type I storm is suggested for certain Pacific Coast and Gulf Coast applications, the Type I storm more closely resembled the ADOT regression curve results. Therefore the Type I storm shall be utilized for watersheds 20 to 100 square miles in size.

3.3 Rational Equation

The rational equation has long been used by engineers as a simplified method to develop an estimate for flood peaks. The method itself continues to be widely used for roadway drainage and flow peaks from small watersheds. The Town of Oro Valley limits the use of the rational equation to areas no larger than 100 acres in size. The basic rational equation is in the form of:

$$Q = CiA$$

Where:

Q = Flow rate in cubic feet per second
C = Runoff Coefficient; see Table 3-3.
i = Rainfall intensity at Time of Concentration, see Figure 3-3: Town of Oro Valley Generalized I-D-F Curves
and use T_c = total Rainfall Duration in the I-D-F curve. Minimum T_c shall be 5 minutes or greater.
A = Drainage area in acres

The weighted runoff coefficient will be estimated by:

$$Cw = \frac{\sum_1^n A_n C_n}{\sum_1^n A_n}$$

Where:

C_w = Weighted C

C_n = Runoff coefficient for sub-area "n", see Table 3-3

A = Area for sub-area "n"

Table 3-2: Rainfall Depths of Various Return Periods for Oro Valley Site-Specific I-D-F Curves

Return Period (Years)	*Rainfall Depths (inches)*		
	1-Hour (P_1)	*2-Hour*	*3-Hour*
2	1.26	1.37	1.45
5	1.62	1.79	1.91
10	1.87	2.08	2.23
25	2.22	2.49	2.67
50	2.49	2.80	3.01
100	2.77	3.12	3.35
500	3.39	3.84	4.14

Table 3-3: C Coefficients for Use with the Rational Method

	*Intensity of Landuse**																		
Rainfall Depth (in)	***Applicable Soil Types***				***(≤10%) Nat./Rural***			***(20%) Suburban***			***(40%) Mod. Urban***			***(70%) Hly. Urban***			***(90%) Comm./Ind.***		
P_1	***B***	***C***	***D***	***I***	***B***	***C***	***D***	***B***	***C***	***D***	***B***	***C***	***D***	***B***	***C***	***D***	***B***	***C***	***D***
0.9	.02	.09	.16	.88	.11	.17	.23	.19	.25	.30	.36	.41	.45	.62	.64	.66	.79	.80	.81
1.0	.05	.14	.22	.89	.13	.22	.29	.22	.29	.35	.39	.44	.49	.64	.67	.69	.81	.82	.82
1.1	.09	.19	.28	.90	.17	.26	.34	.25	.33	.40	.41	.47	.53	.66	.69	.71	.82	.83	.84
1.2	.12	.23	.33	.91	.20	.30	.39	.28	.37	.45	.44	.50	.56	.67	.71	.74	.83	.84	.85
1.3	.16	.28	.38	.91	.24	.34	.43	.31	.41	.49	.46	.53	.59	.69	.72	.75	.84	.85	.86
1.4	.20	.32	.42	.92	.27	.38	.47	.34	.44	.52	.49	.56	.62	.70	.74	.77	.85	.86	.87
1.5	.24	.37	.46	.92	.31	.43	.51	.38	.48	.55	.51	.59	.64	.72	.76	.78	.85	.87	.87
1.6	.28	.40	.50	.93	.35	.45	.54	.41	.51	.59	.54	.61	.67	.74	.77	.80	.87	.88	.89
1.7	.31	.44	.53	.93	.37	.49	.57	.43	.54	.61	.56	.64	.69	.74	.78	.81	.87	.88	.89
1.8	.34	.47	.56	.94	.40	.52	.60	.46	.56	.64	.58	.66	.71	.76	.80	.83	.88	.89	.90
1.9	.37	.50	.59	.94	.43	.54	.63	.48	.59	.66	.60	.68	.73	.77	.81	.84	.88	.90	.91
2.0	.40	.53	.62	.94	.45	.57	.65	.51	.61	.68	.62	.69	.75	.78	.82	.84	.89	.90	.91
2.1	.43	.55	.64	.94	.48	.59	.67	.53	.63	.70	.63	.71	.76	.79	.82	.85	.89	.91	.91
2.2	.45	.57	.66	.95	.50	.61	.69	.55	.65	.72	.65	.72	.78	.80	.84	.86	.90	.91	.92
2.3	.47	.59	.68	.95	.52	.63	.71	.57	.66	.73	.66	.73	.79	.81	.84	.87	.90	.91	.92
2.4	.50	.61	.69	.95	.55	.64	.72	.59	.68	.74	.68	.75	.79	.82	.85	.87	.91	.92	.92
2.5	.52	.63	.71	.95	.56	.66	.73	.61	.69	.76	.69	.76	.81	.82	.85	.88	.91	.92	.93
2.6	.53	.65	.72	.95	.57	.68	.74	.61	.71	.77	.70	.77	.81	.82	.86	.88	.91	.92	.93
2.7	.55	.66	.74	.96	.59	.69	.76	.63	.72	.78	.71	.78	.83	.84	.87	.89	.92	.93	.94
2.8	.57	.68	.75	.96	.61	.71	.77	.65	.74	.79	.73	.79	.83	.84	.88	.90	.92	.93	.94
2.9	.58	.69	.76	.96	.62	.72	.78	.66	.74	.80	.73	.80	.84	.85	.88	.90	.92	.93	.94
3.0	.60	.70	.77	.96	.64	.73	.79	.67	.75	.81	.74	.80	.85	.85	.88	.90	.92	.93	.94

Where: P1 = One-hour rainfall depth for the desired return period
B = Type "B" soils (NRCS Classification)
C = Type "C" soils (NRCS Classification)
D = Type "D" soils (NRCS Classification)
I = Impervious surface
*Percent in parentheses represents amount of impervious cover.

Note: Table 3-3 from "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona"

Example application of Table 3-2 for 100-year Weighted Runoff Coefficient:

100-year Rainfall Depth (P_1) = 2.45 inches.

Soil Types = 35% B; 65% D.

Pervious Cover = 70%; Impervious Cover = 30%.

$C_{w\,100}$ = (0.7)(0.35)[0.50 + 0.5(0.52-0.50)] +
(0.7)(0.65)[0.69 + 0.5(0.71-0.69)] +
(0.3)[0.95 + 0.5(0.95-0.95)].

$C_{w\,100}$ = (0.7)(0.634) + (0.3)(0.95) = 0.729.

See procedure in ADOT Highway Drainage Design Manual Chapter 1 for manual calculation of site-specific I-D-F values as shown in Table 3-3. Rainfall intensity and depth values found by manual calculation may very slightly from those extracted from the Oro Valley site-specific I-D-F curve (Figure 3-3). Variations among rainfall intensity (i) values may result from 1) individual interpolation of isopluvial values found in the precipitation maps at the end of the ADOT Highway Drainage Design Manual (manual calculation of values) and 2) interpolation of axis values from the existing graphical I-D-F curve. (Note that the I-D-F curve is a base ten log-log plot and all attempts should be made to interpolate values accordingly). Minor variations in rainfall intensity values are anticipated, relatively insignificant and acceptable.

3.3.1 Hydrologic Soil Groups - Descriptions

Hydrologic soil groups may be determined by either geotechnical evaluation or by the published Natural Resources Conservation Service (NRCS) Pima County data base. This data is available through the Pima County GIS Services Departments Map Guide web page at:

http://www.dot.co.pima.az.us/gis/maps/mapguide/

Soil Group A (Low runoff potential when thoroughly wet; high rate of water transmission) – Soils having high infiltration rates even when thoroughly wetted and consisting of deep, well to excessively well draining sands or gravels. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Group A soils are generally found within washes throughout Pima County, Arizona.

If this type of soil is encountered within the developable limits of the project, the office of the Town Engineer must be consulted to determine the proper parameters for determining the runoff coefficient.

Soil Group B (Moderately low runoff potential when thoroughly wet; moderate rate of water transmission) – Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with

moderately fine to moderately coarse textures. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures.

Soil Group C (Moderately high runoff potential when thoroughly wet; slow rate of water transmission) – Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of soils with a layer that impedes the downward movement of water, or soils with moderately fine to fine texture and a slow infiltration rate. Water transmission through this soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures.

Soil Group D (High runoff potential when thoroughly wet; very slow rate of water transmission) – Soils having a very slow infiltration rate when thoroughly wetted, consisting chiefly of clay soils with a high swelling potential; soils with claypan or clay layer at or near the surface; and shallow soils over nearly impervious materials. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures.

For soils that are combinations of the above groups, a weighted coefficient for runoff must be estimated by the following equation:

$$C_{cs} = \frac{\sum_{1}^{n} P_n C_n}{100}$$

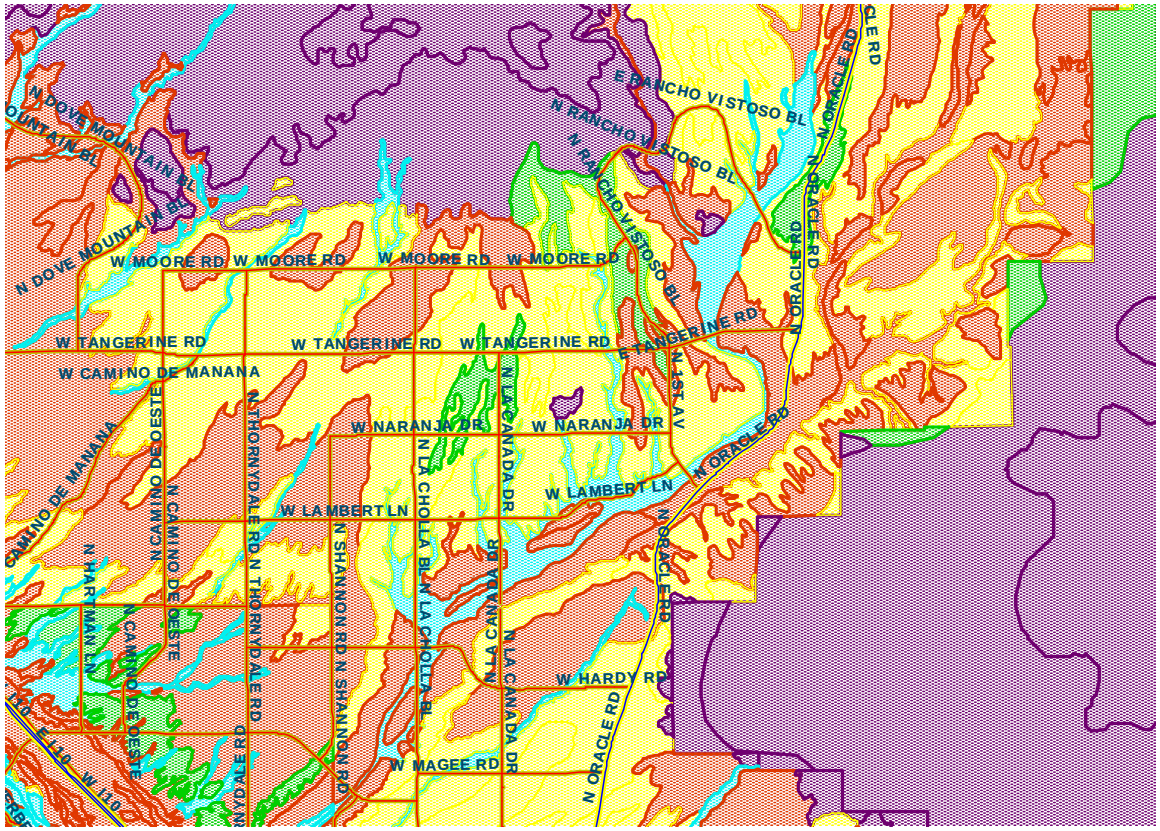
Where:

C_{cs} = Estimated C from the soil combination

C_n = Runoff coefficient for each soil type present

P = Percentage of soil for each soil type present

Figure 3-2: NRCS Overview for the Town of Oro Valley, Soil Group Descriptions

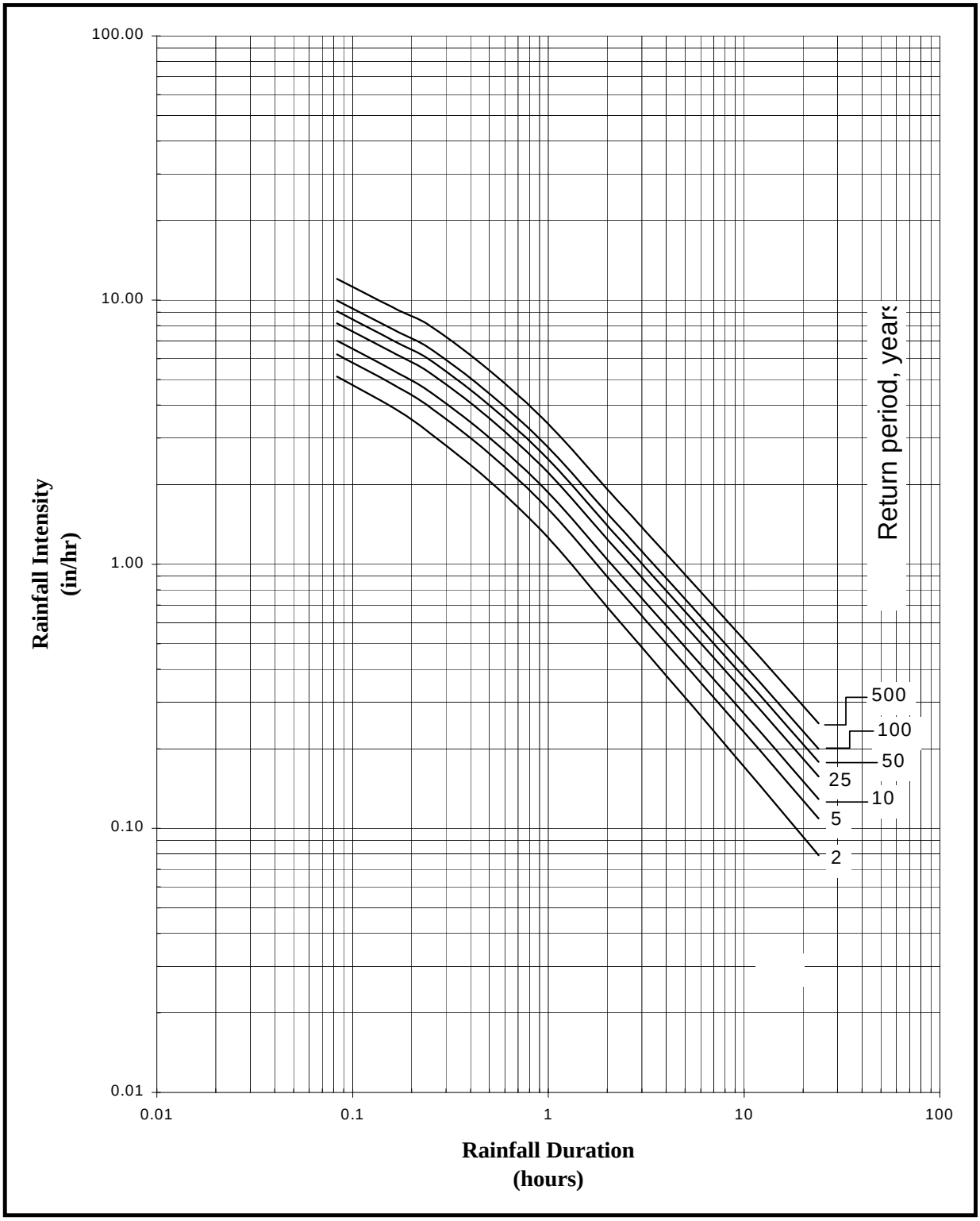


LEGEND

Soil Group: A (100%)		**Soil Group: B (100%)**	
Soil Group: C (100%)		**Soil Group: D (100%)**	
		Soil Group: Mixed[1]	

[1] For mixed soil group ratios see Pima County on line GIS Hydrologic Soils Group Map by (NRCS).

Figure 3-3: Town of Oro Valley Generalized I-D-F Curves



3.4 Rainfall Runoff Modeling (HEC-1 or HEC-HMS)

The Town of Oro Valley encourages the use of a rainfall runoff model that provides estimates of peak rate of flow, volumes, and runoff hydrographs. The preferred modeling tools are the U.S. Army Corps of Engineers' hydrology models HEC-1 or HEC-HMS. HEC-1 has been supported for many years by the Corp's Hydrologic Engineering Center. In recent years, the Corps has developed HMS, which is intended to replace HEC-1. HMS will contain most of the same algorithms as HEC-1, but it is being developed to provide an interface for today's users, who are more familiar with a Windows-based versus a DOS-based interface. Copies of these models and supporting manuals can be downloaded from the Corps Hydrologic Engineering Center at no cost. Other hydrologic models will be considered on a case-by-case basis by the Town Engineer. Designers are encouraged to seek approval of these alternative methods before initiating design work. Full support documentation will be required for approval prior to gaining the Town Engineer's approval. Input data and parameters, and results must be clearly and concisely annotated on printout sheets attached to the drainage report.

Another important design manual is the Highway Drainage Design Manual–Hydrology Report Number FHWA-AZ93-281. This report can be ordered from the Arizona Department of Transportation, Engineering Records Section, 1655 W. Jackson, Room 175, Mail Drop 112F, Phoenix, Arizona 85007-3217.

3.4.1 Rainfall

For purposes of rainfall runoff modeling, the designer shall use the Oro Valley 3-hour storm when the total drainage area is less than 10 square miles in size; and the Type I 24-hour storm when the total drainage area is more than 20 square miles. For drainage areas between 10 and 20 square miles, the designer shall evaluate both the 3- and 24-hour results and select the method that is most consistent with the results of the ADOT regional regression equations.

The designer shall select the more conservative of the two results for application. In the event that the result is unreasonably high or low, the designer may adjust the value. A determination of "Unreasonably high or low" is based on the resulting peak being more than one standard deviation higher or lower than the mean value predicted in the ADOT regression equation for that return period. By definition, the published standard error value in the ADOT regression table is equivalent to the standard deviation and the results are to be adjusted such that it no longer is outside this band. However, in the event that values are being lowered; it is the designer's responsibility to examine whether physical circumstances may be influencing the higher result. Examples include watersheds steeper than typical; watersheds that are shaped such that the bulk of the drainage area is at the lower end of the watershed; watersheds that have significantly higher impervious factors related to soil, rock, and urbanization; and other factors. This documentation shall be provided to the Town for review and comment.

Point Rainfall Depths

Table 3-4: Local Thunderstorm and General Summer Storm "Point" Rainfall Depths

Return Period	*Local Thunderstorm[1] (3-hour)[2]*	*General Summer Storm[1] (24-hour)[3]*
2	1.45	1.90
5	1.91	2.62
10	2.23	3.10
25	2.67	3.77
50	3.01	4.29
100	3.35	4.80
500	4.14	5.99

[1] From Town of Oro Valley, Town Wide Drainage Study, and Localized I-D-F curve as calculated from methodology outlined in Arizona Department of Transportation (ADOT) Hydrology Manual.
[2] Values for drainage areas ≤ 10 mi^2
[3] Values for drainage areas ≥ 20 mi^2. For watersheds between 10 and 20 mi^2 see section 3.4.1

Temporal Distribution

Table 3-5: Temporal Distribution of Oro Valley 3-Hour Storm

Minutes	*% of 3-Hour Depth*	*Minutes*	*% of 3-Hour Depth*	*Minutes*	*% of 3-Hour Depth*	*Minutes*	*% of 3-Hour Depth*
5	0.6	50	6.7	95	66.6	140	94.7
10	1.2	55	7.6	100	76.2	145	95.6
15	1.8	60	8.8	105	81.5	150	96.5
20	2.3	65	11.1	110	85.0	155	97.1
25	2.9	70	13.8	115	88.0	160	97.7
30	3.5	75	17.0	120	90.6	165	98.2
35	4.1	80	21.7	125	91.8	170	98.8
40	5.0	85	27.9	130	93.0	175	99.4
45	5.9	90	41.9	135	93.8	180	100.0

Table 3-6: Temporal Distribution of SCS (NRCS) Type I, 24-Hour Storm

Hours	*% of 24-Hour Depth*	*Hours*	*% of 24-Hour Depth*	*Hours*	*% of 24-Hour Depth*	*Hours*	*% of 24-Hour Depth*
0.5	0.8	6.5	14.0	12.5	70.5	18.5	89.3
1	1.7	7	15.6	13	72.7	19	90.5
1.5	2.6	7.5	17.4	13.5	74.8	19.5	91.6
2	3.5	8	19.4	14	76.7	20	92.6
2.5	4.5	8.5	21.9	14.5	78.4	20.5	93.6
3	5.5	9	25.4	15	80.0	21	94.6
3.5	6.5	9.5	30.3	15.5	81.6	21.5	95.5
4	7.6	10	51.5	16	83.0	22	96.5
4.5	8.7	10.5	58.3	16.5	84.4	22.5	97.4
5	9.9	11	62.4	17	85.7	23	98.3
5.5	11.2	11.5	65.4	17.5	87.0	23.5	99.2
6	12.5	12	68.2	18	88.2	24	100.0

Areal Reduced Rainfall Calculation

Areal reduction factors are utilized by the HEC-1 model to reduce the point precipitation value as the contributing drainage area increases. Reductions are calculated based on the equations below for each storm event. The areal reduction for the Oro Valley 3-Hour Storm is the same as that developed as part of the Hydrologic Modeling for the Tucson Stormwater Management Study (TSMS).

ORO VALLEY 3-Hour Storm

$$Pr_x = Pn_x(A^{-[\log A(0.07)+0.027]})$$

Where:

Pr_x =areal reduced rainfall depth
A = watershed area in square miles
Pn_x = rainfall depth for the n^{th} return period for the x-hr duration storm
n = year return period used for this computation
x =-hour storm duration used for this computation

SCS (NRCS) Type I, 24-Hour Storm

$$Pr_{24} = Pn_{24}(1-(0.09(1-2.71828^{-0.015A})))$$

Where:

Pr_{24}= Areal reduced rainfall depth
A = Watershed area in square miles
Pn_{24} = Rainfall depth for the n^{th} return period for the 24-hour duration storm
n = Year return period used for this computation
Thunderstorm > 1mi.

3.4.2 Loss Rate Methods

The loss rate parameter is used to estimate the amount of rainfall that infiltrates (loss), and that rainfall that runs off (excess). Various methods can be used to estimate the amount of loss. However, the Town of Oro Valley prefers the use of loss rate methods that tend to directly evaluate the infiltration rate of the soil as compared to the rainfall intensity. Two methods that are widely used and that allow for this approach are the Green and Ampt equation, and the initial and uniform loss rate. The Green and Ampt approach is directly related to soil textures. The initial and uniform loss rate approach requires an independent estimate of saturated infiltration rate.

There are five parameters within the Green and Ampt Method; these include surface retention loss (IA), hydraulic conductivity (XKSAT), wetting front capillary suction (PSIF), volumetric soil moisture deficit (DTHETA), and the percent impervious (RTIMP). Surface retention loss values are determined from land use and surface cover, which represent the summation of all rainfall losses other than infiltration.

Table 3-7: Surface Retention Loss for Various Land Surfaces in Arizona

Land-Use and /or Surface Cover	*Surface Retention Loss (Ia) (inches)*
Natural	
Desert and range land, flat slope	0.35
Desert and range land, hill slopes	0.15
Mountain, with vegetation surface	0.25
DEVELOPED (RESIDENTIAL AND COMMERCIAL)	
Lawn and turf	0.2
Desert landscape	0.1
Pavement	0.05
Agricultural	
Tilled fields and irrigated pasture	0.5

Source: Maricopa County Drainage Design Manual, Vol. I Hydrology

These values have been selected to fit many typical settings in Oro Valley. The engineer/hydrologist should **always** evaluate the specific circumstances in any particular watershed for hydrological variations from these typical values.

The following table is intended to assist the designer with the selection of Green and Ampt parameters based on common Soil types within the Oro Valley area. The designer is cautioned to independently verify these parameters, and to propose adjustments as necessary, based on local site knowledge.

Table 3-8: Green and Ampt Loss Rate Parameter Values for Bare Ground

Soil Texture Classification	*XKSAT (inches/hr)*	*PSIF (inches)*	*DTHETA*	
			Dry	*Normal*
Gravelly loamy coarse sand	1.20	2.40	0.35	0.30
Sandy loam	0.40	4.30	0.35	0.25
Loam	0.25	3.50	0.35	0.25
Silty loam	0.15	6.60	0.40	0.25

Additional information on the use of loss rate parameters can be found in Chapter 3 of the ADOT Hydrology Manual.

Table 3-9 contains suggestions for selecting IA, RTIMP, and percent vegetative cover for urban areas. These values are meant as a guideline and are not to be taken as prescribed values for these parameters. Note also that the values for RTIMP reflect *effective* impervious areas, not *total* impervious areas. As noted, the percent of vegetative cover is for the pervious areas only. These three parameters are used in the calculation of average sub-basin parameters for the Green and Ampt loss method as described above and in the ADOT Hydrology Manual. Engineering judgment and experience should be used when selecting rainfall loss parameters and assigning land use categories for any watershed.

Table 3-9: IA, RTIMP, and Percent Vegetative Cover for Various Land Uses in Oro Valley

Zoning Designation	*Land Use Category*	*IA (inches)*	*RTIMP (percent)*	*Veg. Cover (percent)*	*Oro Valley*	
					Zoning	*Description*
Open Desert	Open Desert	0.5	0	35		
VLDR	Very Low Density Residential	0.3	5	30	R1-144 R1-43 RH-600	Rural Residential Rural Residential Rural Residential
LDR	Low Density Residential	0.3	15	50	R1-36 R1-20	SF, Residential SF, Residential
MDR	Medium Density Residential	0.25	30	50	R1-10 R1-7	SF, Residential SF, Residential
HDR	Multiple Family Residential	0.25	45	50	R-4 R-6 R-4R SDH-6	Townhouse Residential Multi-family Residential Resort District Site Delivered Housing
I	Industrial	0.15	55	60		
C	Commercial	0.1	80	75	C-1 C-2 C-N T-P	Community Commercial Regional Commercial Neighborhood Commercial Technology Park
PS&C	Private Schools and Churches	0.25	25	50	PS&C	Private Schools and Churches
C-R	Golf Course/Club House	0.6	5	50		
	Miscellaneous				PAD	Planned Area Development

3.4.3 Unit Hydrograph and Time of Concentration

In rainfall runoff modeling, it is necessary to transform the runoff into a hydrograph. Unit hydrograph methods continue to be a well-accepted means of performing this translation. The recommended unit hydrograph procedure is the Clark Unit Hydrograph. The Clark Method is unique, as compared to other more commonly used unit hydrograph approaches, in that the method incorporates three parameters; time of concentration, a storage coefficient, and a time area factor that considers the timing of runoff from different sectors of the watershed. Section 4.2 of the ADOT Hydrology Manual provides computational methods and input for these parameters.

Kinematic wave methods also can be used by the experienced designer to generate sub-basin hydrographs. However, the designer is encouraged to only use this approach in developed areas with well-defined flow paths (e.g. curb and gutter, well-defined drainage swales, etc.) A caution to the user is that Kinematic wave methods are quite easy to use, however they tend to move flood flows too rapidly through systems that are ill-defined or undersized, leading to potential overestimating of flood peaks.

3.4.4 Routing (Channel, Storage and Transmission Losses)

Once a sub-basin hydrograph is developed, it is "moved" or routed downstream so that it can be combined with other sub-basin hydrographs prior to the ultimate point of concentration. There are essentially two types of routing that occur; channel; and storage. Essentially three natural phenomena are being mathematically simulated in routing; flood wave translation (the movement of the flood wave in the system); attenuation (how the flood wave might be dampened due to in-channel or reservoir storage functions), and transmission losses (infiltration).

Of the various routing methods available, it is recommended that the normal depth approach be used for channel routing. The normal depth method allows for the input of a simplified 8-point channel cross-section from which velocity and storage relationships are developed internal to the model. Kinematic wave routing can be used in areas where channel sections have been modified for flood control purposes, and the level of maintenance is high. Muskingum routing and other routing methods may be used by the experienced designer, providing they have data to substantiate their use.

Storage routing is used primarily to simulate reservoirs or detention structures. Both ADOT and HEC-HMS provide good documentation on the application of reservoir routing. Designers are encouraged, however, to input their own rating curves for outflow rather than allowing the model to compute pipe flow and overtopping. The primary reasoning for this is that models utilize simplified assumptions in computing outflow curves. These assumptions are best suited for situations where outflow is clearly controlled at the entrance to the pipe. If the designer opts to have the models compute pipe flow and overtopping, then a supporting curve must be provided.

For large watershed studies, transmission losses (the infiltration of water into the channel bottom) can be significant. For most development type projects, these losses are usually insignificant. Transmission losses will be considered on a case by case basis, if the designer has supporting data to justify these losses. Note that if transmission losses are assumed by the designer, the method must be used in both existing condition and developed condition models.

3.5 Evaluation of Results

The designer is urged to perform an independent evaluation of model results as compared to other methods. For watershed studies in excess of 10 square miles, the designer is required to submit this evaluation. The suggested method is the regional regression approach suggested in the ADOT drainage manual. If results are more than 10% lower than those suggested by the ADOT equations, the Town may require additional justification in terms of modeling parameters and approach.

4. FLOODPLAIN MANAGEMENT

Except as otherwise specified, all land development, construction of residential, commercial, or industrial structures, or future development within and adjacent to delineated floodplain areas is subject to the terms of the Floodplain and Erosion Hazard Management Ordinance. Refer to Town of Oro Valley Floodplain Ordinance (Appendix B) for management of FEMA regulatory and non-FEMA washes or sheet flow areas greater than 50 cfs. Description of the Floodplain Use Permit and application process, construction and subdivision standards, erosion-prone areas, variances, etc. are described in Appendix B.

4.1 Overview

"The Federal Emergency Management Agency (FEMA) assisted by the Arizona Department of Water Resources, National Flood Insurance Program State Coordinator, has primary responsibilities for administration of the National Flood Insurance Program and flood hazard mitigation. The federal and state requirements mandate that any community that has FEMA designated floodplains within their jurisdictional boundaries have and maintain an up-to-date and current floodplain and erosion hazard management ordinance" (Council Communication dated October 2005). Oro Valley has such FEMA-designated floodplains and to assure compliance with federal and state technical and regulatory requirements, has adopted the "Floodplain and Erosion Hazard Management Ordinance" as Chapter 17 of the Oro Valley Town Code.

4.2 Purpose

The purpose of the Floodplain and Erosion Hazard Management Ordinance is to "…promote the public health, safety and welfare, and to minimize public and private losses due to flood conditions in specific areas…" caused by "…the cumulative effect of obstructions in the regulatory floodplain which increase flood heights and velocities."

4.3 Cañada del Oro Wash (CDO) Special Floodway Requirements

No water surface elevation increases due to encroachment shall be allowed in the Cañada del Oro Wash. Refer to section 17-5-8 of the Town Code and Floodplain & Erosion Hazard Management Ordinance.

5. OPEN CHANNEL HYDRAULICS

5.1 Criteria

The section on general policy primarily refers to natural channels; the section on design policy primarily refers to constructed drainage channels. It is not the intent of this manual to encourage the modification of natural channels to meet the criteria for designed channels.

Table 5-1: Natural vs. Design Channels

Policy	*Parameter*	*Standard*	*Comment*
NATURAL CHANNELS	Point of ingress and egress to property	No change in location allowed	
	Increase in water surface	No more than 0.1 foot	Measured off-site
	Increase in velocity	No increase allowed	Measured off-site
	Loss of flood storage	Can not impact flow rate	Analysis at discretion of Town Engineer
	Channel degradation and migration	Can not be accelerated	
	Future condition flow rates	Contained in freeboard, lowest floor at least 1' above future flood level	Review floodplain ordinance
DESIGN CHANNELS	Maximum flow depth	4 feet	
	Maximum velocity	10 fps	
	Side slopes	3:1 or flatter	
	Froude number	<0.8 or >1.2	Avoid instability
	Channel curvature	Per City of Tucson Standards	
	Freeboard	Levees 3 feet with 4 feet at bridge lowest cord; Channels 1 foot if less than 4 feet deep and 10 fps velocity	
	Lateral migration	Per City of Tucson Standards	
	Channel stabilization	Designer to demonstrate that channel is stable	
	Rip-rap sizing, depth, width, etc.	Per City of Tucson Standards.	

5.2 Introduction

Open channels serve multiple purposes. In addition to moving floodwaters; they are linear corridors that are essential to wildlife and valued for their recreation potential, they can be a sanctuary for habitat that is both necessary and aesthetically pleasing. It is the policy of the Town to treat open channels as multiple-use areas, and it is necessary for designers to consider multiple-use functions in their design. For purposes of implementation, open channels are divided between those that naturally occur, and those that are constructed. A naturally occurring channel is one in which the channel bottom is natural, may have an occasional road crossing, and bank protection is limited to protecting in-place the existing bank. A constructed channel is one in which the channel bottom may be hardened and/or the channel alignment has been shifted.

5.3 Channel Construction and Alterations

Prior to commencing channel construction and alteration, it is required that all permits from the Town, in addition to permits from the State and federal governments, be obtained. When altering a floodplain that is mapped on the FEMA Flood Insurance Rate Maps, a Conditional Letter of Map Revision (CLOMR) must be obtained prior to initiating construction. In addition, the CLOMR must be accepted and approved prior to issuance of a floodplain use permit.

It is the policy of the Town that channel construction and modification not result in adverse flooding-related impacts to other property owners. The following criteria shall apply for all proposed channel modifications:

1. Channel modifications shall not alter the historical point where flows enter and leave the property.

2. Mass fill and grading within the channel and associated floodplain shall not result in the increase of existing off-site conditions water surface elevations in excess of 0.1 feet as measured by a backwater analysis.

3. Increased velocities shall be contained within the property on which the channel modifications are constructed. No off-site velocity increase is allowed.

4. Any fill placed in a regulated floodplain shall require an analysis that demonstrates that there is no increase in water surface elevations (pursuant to the Town of Oro Valley Floodplain Management Ordinance) and no increase in flow rates.

5. When a natural channel is to be straightened or stabilized (grade control or bank protection), a sediment and/or fluvial geomorphology analysis is to be prepared. The analysis shall demonstrate that the alteration will not lead to channel degradation/aggradation in excess of that which is expected to occur with existing

conditions; or that the alteration will not lead to modified lateral migration, and that it will not change the watershed hydrology resulting in increased flow rates.

6. The analysis shall consider future condition flow rates that may result due to upstream development either within or outside of the Town. The future condition flow rates shall be contained within the freeboard of a constructed channel, or a natural floodplain shall be used to establish a future flood level. Finished floors shall be set at least one foot higher above the existing flood level and not lower than 6 inches above the future condition flood elevation.

   In addition, it is the responsibility of the designer to comply with all other applicable local, state or federal permits.

In the event that adverse impacts can not be avoided, modifications can proceed providing that one of the following has occurred:

1. Adversely impacted property owners have provided written permission in the form of an easement or other similar vehicle.

2. The modification is part of a regional plan that has undergone appropriate public notice and is adopted by the Town Council.

3. Another form of structural or nonstructural mitigation is provided.

5.4 Channel Analysis and Design

Constructed channels should be designed to a depth of 4-feet or less and a maximum velocity of 10 fps. Outlet velocities for channels with outlets to natural drainage courses shall not exceed velocities described in the Town's Floodplain Management Ordinance – see Appendix B. Channel side slopes should be 3:1 or flatter. Exceptions include:

1. Authorization given by the Town Engineer based on demonstration that the channels will incorporate proper safety measures, that the channel has proper maintenance access, and that the channel can be maintained.

2. The channel modification is defined as the stabilization of a natural wash bank.

3. The constructed channel is similar in dimension to the natural channel it replaces.

The Town prefers the use of backwater methods for establishing velocity and water surface elevations. Models such as HEC-2, HEC-RAS, STORMPLUS, and other similar backwater models may be used in lieu of hand calculations or spreadsheets. Normal depth methods (e.g. Manning's equation) may be used for sizing of small prismatic channel sections (less than 400 cfs), provided that backwater is not encountered. Examples of potential backwater situations would include tributaries, crossings, grade breaks, and variations in the section to name a few.

The designer is to present the Froude number for designed channel sections. Channel designs that lead to Froude numbers, in the range of 0.8 to 1.2, should be avoided unless it can be demonstrated that the flow profile is stable. If a natural channel has a Froude number approaching 1, the designer is to evaluate and present the implications of a hydraulic jump as it relates to water surface elevation and energy loss potential. If it is not possible for the designer to avoid this constraint, the designer must provide locations for areas of controlled hydraulic jumps.

When designing a channel curve superelevation, the maximum radius of curvature should be analyzed per methods of the City of Tucson.

Freeboard is to be provided in all channel and levee designs. Levees must include a minimum of 3-feet of freeboard, and 4-feet at bridges. Channels shall have a minimum of 1-foot of freeboard for channels that are 4-feet in depth or less and have velocities less than 10-feet per second. Channels larger than this shall develop freeboard calculations based on City of Tucson methods.

Lateral migration setbacks for natural and existing channels are to be established based on City of Tucson Methods.

The designer of constructed channels is responsible for demonstrating the need, or lack thereof, for bank protection or invert stabilization. It is assumed that most constructed channels will require some form of stabilization. Designers are encouraged to soften the "engineered" appearance of these constructed channels. The Town will also consider bio-engineered stabilization measures, landscaped channels, channels with stabilization features buried and then covered, and landscaped, or channels designed to mimic a natural channel using the methods of fluvial geomorphology to establish a low flow and floodplain channel section.

5.5 Riparian Channel Design

Environmental interests are increasingly shifting the emphasis from constructing vegetation-free (e.g. concrete or earthen) channels to creating more natural vegetated drainages that facilitate wildlife habitat, and provide more aesthetically pleasing areas within developed regions.

Riparian channel design is a process where constructed drainage channels mimic natural channels. Riparian channels are designed to be stable such that lateral channel migration, degradation, and aggregation are minimized. This stability is partially achieved by designing the riparian channel corridors to be wider than standard constructed drainage channels. The wider channel design allows for consideration of flood flow conveyance elements, wildlife habitat, vegetation preservation and esthetic elements. The overall benefit is a more appealing environment.

In the development of an approach that will integrate elements of flood flow conveyance, wildlife habitat, vegetation preservation and enhanced aesthetics of urban drainages, consideration should be given to the following factors:

5.5.1 Design Concept

1. Hydraulic analysis of the proposed design shall be prepared such that there is a hierarchy of dedicated flow paths and Water Surface Elevation (WSEL) delineations associated with specific flood flow frequencies. The following describes a possible example (see Figure 5-1):

    i. A clear flow path to accommodate the 10-year event which delineates the 10-year WSEL.

        (a) Toe-down structures along the 10-year flood flow delineations.

    ii. A more vegetated flow path to accommodate the 100-year event which delineates the 100-year WSEL and is between the 10-year and 100-year event delineations.

    iii. An area outside the 100-year event limits with a higher variety of vegetation and trees.

    iv. Consideration of flow over the 100-year event flow and how these low frequency events can be properly conveyed from the site.

        (a) This consideration relates to the upper limits of the stream banks and possibly locating weir structures along the stream bank.

2. Types of in-channel vegetation and their effects on the conveyance of flood flows shall be determined according to a flood flow frequency hierarchy such as discussed above.

3. Distribution of in-channel vegetation and the effects on flow conveyance and water surface elevation shall be determined according to a flood flow frequency hierarchy such as discussed in 5.5,1. above.

4. Recommendations for energy dissipation and the need for grade control structures.

5. Recommendations for revegetating channels and vegetation maintenance requirements to include consideration of:

    i. Effects of vegetation density on flow conveyance.

    ii. Hierarchy of dedicated flow paths, type of vegetation and distribution of vegetation type as discussed in item 5.5,1. above.

iii. Potential for natural revegetation of channels in accordance with a vegetation management plan for the channel.

iv. Presence of invasive species and measures to eliminate them.

v. Time for vegetation to reestablish and become "flood" resistant.

vi. Protection of vegetation during the reestablishment period.

5.5.2 Design Criteria

The natural or "Riparian Channel Design" illustrated in Figure 5-1 and discussed in 5.5-1 above must meet, at a minimum, the following design criteria:

1. Sufficient vegetation density and variety so as to essentially mimic natural washes in the area. However, the 10-year flow area shall not be planted with trees or large shrubs. Specific planting templates and landscape plans shall be approved by the Public Works and Planning Departments;

2. The channel must be designed to maintain equilibrium. The drainage report shall demonstrate/analyze the following;

   a. The channel shall be designed to convey the 100-year flow and exhibit the ability to contain all additional freeboard within the bank profile. There will be no breakout unless the freeboard is breached due to a flow generated from a storm event greater than 100-year design.

   b. In the event of a breach of the 100-year flood limits, provide an analysis of the possible flow path and ensure that this excess flow can drain.

   c. Equilibrium slope, lateral migration, bed scour, sediment transport, etc; shall be evaluated.

   d. Cut-off walls shall be installed at the outer limits of the 10-year floodplain and constructed to 1-foot below the 10-year flow total scour depth;

   e. These design parameters apply to washes between 50 and 3,000 cfs as determined by a 100-year storm event.

   f. The Manning's roughness coefficient n (Manning n) shall be determined by either of the following two methods:

      i. empirical estimation of Manning n from tables. The following range of Manning n values is an example:

         1. 0.025 - to - 0.045 for Clean, straight channels - to - Clean, winding channels with some shoals.

2. 0.035 - to - 0.060 for the same conditions as 1. above with some weeds and stones - to - more stones and vegetation.

3. 0.055 - to - 0.080 for the same conditions as 2. above with increasing vegetation and stones - to - sluggish reaches, heavy vegetation and trees.

Note: There are many tabulated sources of Manning n values for natural and man-made channels some with accompanying photos to allow for a better visual estimation of these empirically derived values.

ii. utilizing the calculation method set in:

Method to Estimate Effects of Flow-Induced Vegetation Changes on Channel Conveyances of Streams in Central Arizona, Water-Resources Investigations Report 98-4040

By the USGS

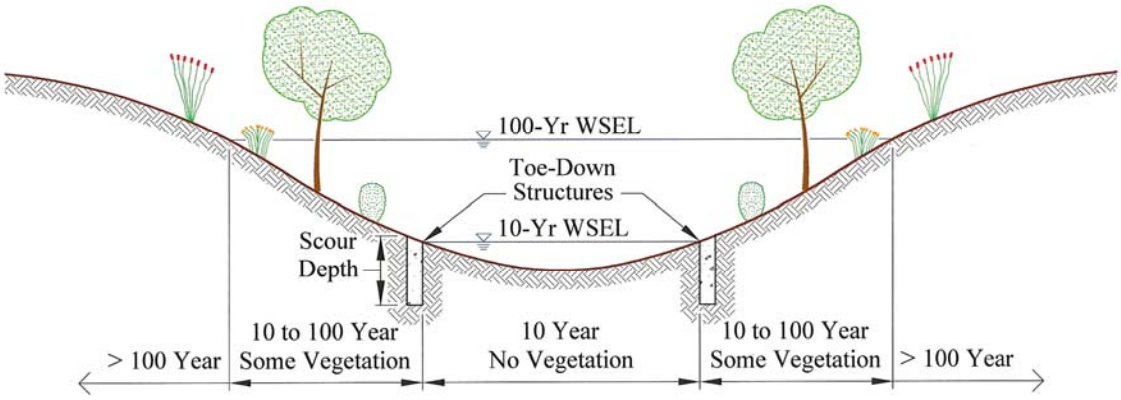


Figure 5-1: Riparian Channel Design

5.5.3 Maintenance

Thorough, routine maintenance is required to ensure adequate performance for the life of proposed riparian channels. The drainage report and landscape plan shall address the following:

1. Access is to be provided to all channels and appurtenant structures and facilities. Access is to be clearly delineated on the grading plans, landscape plans and final plat and shall be contained within a delineated, dedicated easement. For channels three feet in depth and greater and/or 24-feet and wider a vehicle access ramp shall be provided which is suitable in width and construction to safely accommodate equipment such as skid steer loaders. The slope of the access ramp shall not exceed 6:1 (horizontal to vertical) and shall extend

from the top of the channel to the invert. Vegetation shall not be permitted on the ramp's surface.

2. Vegetation irrigation and maintenance schedules shall be provided as an appendix to the drainage report and in tabular or note form on the landscape plan.
3. Non-native invasive species shall be addressed and a control and/or elimination plan discussed.
4. The maintenance schedule and requirements shall be detailed in private Covenants, Conditions and Restrictions (CC&Rs). The Homeowner's Association (HOA) or responsible party shall be clearly identified within the CC&Rs and shall be responsible for maintenance of channels and channel appurtenances, and maintenance record keeping. Maintenance records shall indicate:
    - ❑ Date of maintenance activities;
    - ❑ Description of maintenance activities;
    - ❑ Photographs of the channel and appurtenances before and following maintenance activities;
    - ❑ Signature of responsible individual (i.e. HOA President) certifying that the maintenance was completed according to the approved schedule and requirements, and that the channel(s) and appurtenances substantially comply with the approved improvement plans; and
    - ❑ Maintenance records shall be retained by responsible party for three years following the most recent maintenance activity. The maintenance records shall be provided to the Town of Oro Valley within 10 working days following written request by the Town Engineer.

Subject to the Town Engineer's written approval, channel maintenance schedules and requirements may be modified following a three-year period of operation. Supporting documentation for such a request is to include, at a minimum:

1. Past maintenance records and photographs spanning the previous three years (if applicable);
2. Current photographs of the basin and basin appurtenances;
3. A written explanation for the request to modify the maintenance requirements.

5.6 Security Barriers

1. Security barriers must be provided at the top of all channels with slopes steeper than 4:1, where water depths exceed two feet:
    a. Barriers may consist of vegetation, masonry, wood, steel picket guardrail conforming to building code or chain-link fence. A combination of vegetation and structural materials are preferred.

b. Vegetation shall not be considered an adequate barrier until it has matured and inhibits through pedestrian access. Vegetative barriers must be of a width equal to or greater than overall height, with density sufficient to restrict access.

c. A minimum 42-inch barrier height is required for all basins.

d. Barriers are required on any side of a channel where buildings or other restrictive structures are within five feet of the top of side slope, and have no points of exit or entry into the channel area.

e. Fencing, if required, shall not restrict the hydraulic capacity of the structures.

f. Guardrails must be provided, as required by the Town adopted Building Code, for retaining walls on any inlet and outlet structure headwalls and wing-walls, side retaining or cutoff walls.

g. A lockable gate shall be installed at access ramp is the ramp is in an area that requires barriers.

2. For channels with depths greater than 5 feet and have side slopes greater 2:1, emergency escape ladders consisting of a series of iron rungs shall be installed at intervals no greater than 600 feet apart.

6. SUBDIVISION (LOCAL) STREET DRAINAGE

6.1 Criteria

The criteria in this section are intended to be used in the evaluation of the allowable drainage encroachment within public and private streets, driveways and Parking Area Access Lanes (PAAL).

Table 6-1: Street Drainage Criteria

Policy	*Parameter*	*Standard*	*Comment*
Street **With**: Curb and Gutter	Peak Discharge for the 100-year storm	Street drainage shall not exceed 50 cubic feet per second (cfs) Maximum allowable depth of 6 inches above pavement surface. Runoff to be contained within curbs.	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
	Peak Discharge for the 10-year storm	The runoff must be contained within street curbs. For collector and arterial streets one 12-foot dry driving lane must be maintained in each direction	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
Street **Without**: Curb and Gutter	Peak Discharge for the 100-year storm	Street drainage shall not exceed 50 cubic feet per second (cfs) Maximum allowable depth of 6 inches above pavement surface. Runoff to be confined to road right of way or to drainage easements.	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
	Peak Discharge for the 10-year storm	Water surface elevation below roadway pavement's subgrade for runoff contained within roadside channels.	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
Street With: Storm Drain System	Peak Discharge for the 100-year storm	Catch basins, scuppers, etc., to be provided to remove runoff so as not to exceed the maximum allowable depth of 6 inches.	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
	Peak Discharge for the 10-year storm	Dry-lane accessibility Roadside channels are to be supplemented with pipes to accommodate flows that exceed the 10-year runoff street capacity.	Refer to Town of Oro Valley Subdivision Street Standards, as applicable
Dip Crossings	Depth of Flow	0.5 feet deep at low point for the 100-year storm	

6.2 Introduction

This section is meant to be a supplement to existing street standards located in the Town's *"Subdivision Street Standards," "Zoning Code,"* and *"Floodplain Management Ordinance."* If this Manual or other standards conflict with a code or ordinance, the most conservative approach shall apply.

6.3 Street Drainage

Streets, driveways and PAALs are not to be used as drainage corridors or for the conveyance of off-site flows. However it is understood that nuisance flows associated with runoff and adjacent developments may drain to the streets, driveways and PAALs for short-term conveyance to stormwater facilities. Inverted crown streets are not permitted unless approved by the Town Engineer.

6.4 All-Weather Crossings, Combined Crossings and At-Grade Dip Sections

6.4.1 All-Weather Crossings

At locations where all-weather crossings are required, drainage running transverse to the street or driveway greater than 50 cfs shall be contained in a culvert, or a combined crossing, capable of conveying runoff from a 100-year storm. During the 100-year event, runoff water overtopping the road shall not exceed 6–inches in depth. All weather crossings will be required to adhere to the stipulations set within the Floodplain Management Ordinance.

At Least one all-weather vehicular access shall be provided for every habitable structure within the Town of Oro Valley. This includes, but is not limited to, all commercial, industrial, municipal, institutional (school, church, organization, etc.) buildings as well as all residential structures (single and multi-family dwellings).

In all situations where private vehicular access crosses a FEMA regulatory floodplain located between the points where the private access leaves a paved, publicly maintained roadway and the end of the private access, the owner of the property requiring the private vehicular access shall:

a. Construct at least one private vehicular access in such a manner that it is permanent and is over terrain that can be traversed by conventional motor vehicles during a base flood; and

b. For all other accesses, execute and record a covenant, running with the land and enforceable by the Town of Oro Valley, which contains the following:

   i. An acknowledgment that the private vehicular access may be impassable to conventional motor vehicles and emergency vehicles in times of flooding,

   ii. A hold-harmless provision, holding the Town of Oro Valley harmless from and against all injuries and damages resulting from traversing or attempting to traverse the private vehicular access during times of flooding, and

   iii. A provision which either:

      1. Requires the covenant or successors and assigns to erect and maintain a sign(s) in a location(s) and size acceptable to the Town of Oro Valley stating "DO NOT ENTER WHEN FLOODED," or

      2. Causes the covenant or successors and assigns to assume responsibility to notify users of the private vehicular access that it may be impassable in times of flooding, and agree to indemnify and defend the Town of Oro Valley, its officers, employees, servants and agents, against all claims for injuries to persons or damages to property due to the construction, installation, location, operation, safeguarding, maintenance, repair, and condition of the private vehicular access

c. Maintenance and repair of driveway culverts

   i. Culverts in the Right Of Way (ROW) are the responsibility of the owners

   ii. Existing culverts may be replaced only with culvert(s) designed for the flow capacity standards as specified in this document.

   iii. Existing culverts may be replaced with 12-inch diameter culverts provided the flow capacity criterion has been met.

6.4.2 Combined Crossings

A combined crossing conveys drainage/run-off via a combination of culvert(s) and a sag vertical curve at a street/channel intersection. It is intended to pass minor, more frequent flows entirely beneath the street while passing major, less frequent flows over and beneath the roadway surface, (combined culvert(s)/dip crossing). The combined crossing shall be designed such that the maximum depth of flow in the dip crossing part (over roadway flow) is 6-inches for the 100-year event flow.

6.4.3 At-Grade Dip Sections

Dip crossing sections are prohibited on public streets in the Town of Oro Valley and are discouraged on private streets. Dip crossings on private streets will only be allowed in extraordinary cases and written permission of the Town Engineer is required. All at-grade crossings shall be designed to be self-cleaning. In general, those requesting a dip section shall address each and all of the following items in writing to the Town Engineer and sealed by a Professional Engineer registered in the State of Arizona.

1. Demonstrate that flows are infrequent and insignificant - generally less than 10 cfs in a 2-year event, and less than 50 cfs in a 100-year event, with a maximum depth of 6 inches.

2. Demonstrate that the proposed dip crossing section is not limiting all-weather access to habitable structures or critical facilities.

3. Demonstrate that the Town will not incur additional street maintenance and costs for sediment removal or repair of pavements.

4. Demonstrate that hazardous conditions downstream and within the crossing will not result either during or immediately following a flow event.

5. Demonstrate that appropriate signage will be placed at the dip crossing.

6 Demonstrate that not using the dip crossing section is poor engineering design, creates a dry weather hazard, creates a flood and/or erosion hazard to existing properties.

7. All at-grade crossings shall be designed to be self-cleaning. Cross slope of the roadway dip section shall be constructed with a minimum cross slope of 4% unless it is demonstrated that traffic safety controls dictate otherwise. If approved by the Town Engineer, an upstream sediment trap or other means of keeping the dip crossing clear of sediment and debris may be acceptable in lieu of the 4% cross-slope.

8. Other criteria as specified by the Town Engineer.

Dip sections in which the transverse flow is less than or equal to 50 cfs in the 100-year event shall at least be fitted with 6-inch by 12-inch headers. Where flows of greater than 50 cfs in the 100-year event occur, cut-off walls shall be installed. Cut-off walls are required to maintain the integrity of the roadway pavement.

Required cut-off wall depth shall be designed 1-foot deeper than the scour depth determined by use of the approved local scour equations. However, in no case shall the cut-off wall be less that 2-feet in depth upstream and 4-feet downstream. Sliding and overturning moments may need to be analyzed for cut-off wall protected dip sections on all-weather access streets. Cut-off walls shall be placed 4-feet out from the upstream roadway edge of the pavement line and to the edge of the shoulder downstream. The pavement shall be widened to the upstream and downstream cut-off walls. Concrete headers and cut-off walls must be extended at a minimum to the limits of the 100-year floodplain unless directed otherwise by the Town Engineer.

6.5 Curb Openings

Drainage, which is conveyed within the streets, driveways and PAALs while being delivered to channels or outlets, may be disposed of through curb openings not greater than 10-feet in length (bottom width). Curb openings in excess of five-feet in bottom width shall be fitted with a bollard centered within the opening. All curb openings shall be fitted with outlet aprons and approved scour protection. Should the hydraulic design require greater conveyance than can be provided by such an opening, approval from the Town Engineer is required for other structure to be used.

In sidewalk areas, no at-grade curb openings are allowed without approval of the Town Engineer. The designer shall consider pedestrian needs and other related needs by providing scuppers under sidewalks.

7. STORM DRAINS

7.1 Criteria

The use of storm drains is encouraged by the Town. Surface drainage systems can be limiting in many situations and storm drains offer alternative design solutions to achieve a better overall drainage system.

For purposes of design, the following general guidance is offered:

1. A storm drain is any closed conduit that exceeds 300-feet in length, or a pipe that contains more than one-manhole or more than two catch basin inlets; or is a pipe system that in the opinion of the Town Engineer, functions as a storm drain.

2. The minimum acceptable diameter of storm drain pipe is 24-inches, unless approved by the Town Engineer.

3. Reinforced concrete pipe (RCP) is required for storm drains constructed under public streets. Although private streets are not required to have RCP, it is strongly encouraged. The Town will not force the use of RCP under private streets unless soils, load limitations, etc. dictate otherwise. Please note however, the Town of Oro Valley will not accept or take over private streets for maintenance unless and until all non-RCP storm drains have been replaced by RCP.

4. Spiral Ribbed Pipe (SRP) may be used in other locations with the approval of the Town Engineer

5. A backwater analysis is required for all proposed culverts.

6. The HGL for the design event should not conflict with the street drainage standards.

7. Minimal design velocity is 4-feet per second, and is to be checked with a 5-year event. These criteria can be waived if it can be demonstrated that sedimentation along the flow path will be minimal at lower velocities. Examples of acceptable low flow velocity situations are 1) a large parking lot that is protected from off-site flows, or 2) when there is a calculated low sediment transport potential for the flow event in question.

8. Designer must submit plan and profile sheets for storm drains including the plotted HGL. The maximum system HGL through manholes shall be a minimum of one (1) foot below rim elevation.

9. All storm drains shall be maintained according to a maintenance plan.

10. The construction and use of plunge basins are discouraged in the Town of Oro Valley and will only be allowed in extraordinary cases after the items described below have been addressed and after written permission from the Town Engineer has been obtained. A report sealed by a Professional Engineer registered in the State of Arizona shall be submitted to the Town Engineer that demonstrates the following items:

    a. Town will not incur additional maintenance and costs for sediment removal or repair of downstream systems; and

    b. Not using a plunge basin is poor engineering design, creates a flood and/or erosion hazard to existing properties; and

    c. The plunge basin is self-cleaning and self-draining.

    d. The plunge basin will drain within a maximum of six (6) hours; and

    e. Not using the plunge basin presents a significant financial hardship; and

    f. Physical limitations preclude the use of other energy dissipation designs; and

    g. Other criteria as requested and defined by the Town Engineer.

The designer should note that any new storm drains in the Town will discharge into the Town's municipal storm sewer system which includes all constructed and natural washes and must meet the requirements of the Town of Oro Valley Storm Water Management and Discharge Control Ordinance Section 15-24-14.

Further, the designer should note the new storm drains, in particular ones that utilize a natural wash as an outfall may have additional special environmental permitting considerations. Further, the designer should be aware that constructing an outfall in "Waters of the United States" may require a permit under Section 404 of the Clean Water Act (CWA)

For specific design criteria and details, refer to City of Tucson's "Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona.

8. CULVERTS AND BRIDGES

8.1 Criteria

Culverts and bridges are an important aspect of modern drainage design for the primary reason of providing continuous access in times of high drainage flows. Note that this manual provides an outline for the hydraulic design of these structures, and that it is the designer's responsibility to utilize appropriate techniques to ensure the structural integrity of the facility under dry conditions and under wet conditions (uplift forces or localized scour). Analysis and design of structures should generally follow City of Tucson Standards. The following criteria for design apply:

8.1.1 General

1. Determine if the proposed culvert or bridge crossing is within a mapped floodplain. If so, the designer shall incorporate the standards of the Floodplain Management Ordinance.

2. Dip crossing sections are discouraged in the Town of Oro Valley and will only be allowed in extraordinary cases. Written permission of the Town Engineer is required. Refer to Section 6.4 for additional guidance.

3. The designer shall show ponding or backwater limits for the proposed condition as compared to the existing conditions for the design event and the 100-year event. The Town may require easements or other forms of mitigation for increased ponding limits.

8.1.2 Culverts

1 The minimum acceptable diameter of a culvert pipe is twenty-four (24) inches for natural washes unless approved in writing by the Town Engineer.

2 Headwalls are required on all culverts thirty-six (36) in diameter or greater. Acceptable end treatments for culverts less than thirty-six (36) inches are required and shall be approved by the Town Engineer.

3 Headwater depth shall not exceed 1.5 times the diameter or rise of the culvert and in no case exceed one-foot above the existing 100-year water surface. Ponding on adjacent properties cannot exceed 0.1-foot in depth.

4 A backwater analysis is required for all culvert crossings using recognized standards. The Federal Highways Administration (FHWA) document, *"Hydraulic Design of Highway Culverts"* HDS-5, is a comprehensive technical document for the design of culverts.

5 Reinforced concrete pipe (RCP) is required for culverts constructed under public streets. RCP is strongly recommended for private streets. For all other locations concrete pipe, corrugated metal pipes with a smooth interior, or other, similar materials are recommended on all projects within Town limits. Due to the accumulation of sediment, corrugated metal pipe is not recommended unless it can be demonstrated to the satisfaction of the Town Engineer that there would be no adverse impact to sediment transport.

6 The Town of Oro Valley ordinarily accepts a minimum depth of cover for culverts of two feet. If a smaller depth of cover is desired, the design engineer shall provide manufacturers specifications that indicate that the smaller depth of cover is acceptable. The smaller depth of cover is subject to acceptance by the Town Engineer.

7 The minimal design velocity is 4-feet per second, and is to be checked with a 5-year event. This criterion can be waived if it can be demonstrated that the probability of sediment is minimal (e.g. large parking lots that are protected from off-site flows).

8 Outlet protection is required at each culvert location according to the following outlet velocity constraints.

Table 8-1: Culvert Outlet Protection

Outlet Velocity	***Outlet Protection***
< 10 fps	Rip-rap is required with the minimum extent of rip-rap to cover the calculated scour hole.
>10 but < 15 fps	Grouted rip-rap with an acceptable low flow outlet that covers, at a minimum, the calculated scour hole.
>15 fps	An acceptable energy dissipater. Approval from the Town Engineer is required prior to design of structure.

8 The construction and use of plunge basins are discouraged in the Town of Oro Valley and will only be allowed in extraordinary cases after the items described below have been addressed and after written permission from the Town Engineer has been obtained. A report sealed by a Professional Engineer registered in the State of Arizona shall be submitted to the Town Engineer that demonstrate and ensure the following items are addressed:

a. The Town will not incur additional maintenance and costs for sediment removal or repair of downstream systems; and

b. Not using a plunge basin is poor engineering design, creates a flood and/or erosion hazard to existing properties; and

c. The plunge basin is self-cleaning and self-draining.

d. The plunge basin will drain within a maximum of six (6) hours; and

e. Not using the plunge basin presents a significant financial hardship; and

f. Physical limitations preclude the use of other energy dissipation designs; and

g. Other criteria as requested and defined by the Town Engineer.

9. As an acceptable alternative to standard concrete plunge basins the designer may choose to use gabion constructed plunge basins. Gabion plunge basins avoid several of the negative aspects that concrete has.

10. Culverts shall be provided to pass flow under streets without diversion to adjacent property.

8.1.3 Bridges

1. A backwater analysis is required for all proposed bridge structures.

2. The low chord elevation of the bridge shall be higher than the hydraulic grade line for the design event. The minimum chord elevation shall be established as directed by FEMA criteria.

3. Local scour analysis is required for all bridge structures, for piers and abutments. Refer to Section 10.3 for recommendations on this item

4. The designer should consider whether the channel is stable, aggrading, or degrading, and make appropriate adjustments in design based on the design life of the structure.

5. The minimum acceptable height for box culverts, concrete arches or Integra-Arches is 6-feet due to maintenance considerations unless a smaller culvert is approved by the Town Engineer.

Refer City of Tucson Standards for criteria not addressed above

9. BANK STABILIZATION

9.1 Criteria

As part of natural channel processes, a channel bank may become unstable and prone to erosion or bank failure. In these cases, the preferred method of treatment is to establish a minimum set-back distance from the bank. The set-back is a distance from the bank in question to a line within which no structures may be placed. Another alternative would be to grade the bank into a more stable form. However, there are occasions when these methods of treatment are not possible. In such cases, the designer should first document the basis of the instability and the impact stabilization might have on the wash system. While many factors may lead to instability, often times a bank protection solutions treat the visible erosion while ignoring what is actually causing the erosion problem.

Channel downcutting, while a natural process, quite often is accelerated by changes in the watershed. As the channel becomes incised, bank stability is threatened leading to erosion and failure. Examples of these agents that may influence erosion include:

- migrating headcut from a channel excavation, or loss of some channel invert control;
- a channelization project that attempts to straighten the channel or increase the flow velocity through an area;
- changes in watershed hydrology leading to more frequent runoff (e.g. an urbanizing watershed);
- trapping of sediments in reservoirs or other devices.

A stream's natural meandering process will also cause lateral erosion.

9.2 Bank Stabilization Considerations

Bank stabilization can be accomplished by various methods including the use of bio-engineering techniques. The following should be considered regardless of the method used:

1. For all cases, "natural looking" bank stabilization techniques and designs are to be utilized unless an acceptable alternative is approved by the Town Engineer. Natural looking bank stabilization shall be defined as:
    a. Hand placed rock riprap placed over filter fabric. The color of the riprap shall match the natural color of the base channel and the filter fabric shall be completely covered either by the armoring or embedment.

b. Hand placed rock riprap set in grout. The color of the riprap and grout shall match the natural color of the base channel.

c. Plain gunite bank protection shall not be considered "natural looking" unless it is textured and colored to simulate the existing ground.

d. Other mechanical, tile or masonry block systems shall be submitted to the Town for pre-approval prior to implementation.

2. Note: mechanically placed (dumped) rip-rap is not allowed for purposes of stream bank stabilization.

3. Stabilization should account for adequate bank key-in to account for lateral migration, and adequate toe for local scour and degradation.

4. Rip-rap should be sized using the methods of the U.S. Army Corps of Engineers, Federal Highway Administration, "*State Standard 7-98 Watercourse Bank Stabilization*" or other appropriate local reference (specify reference). For flow depths in excess of 3-feet, the principals of tractive force should be considered.

5. Treatments that are porous (rip-rap, gabions, bio-engineered systems) shall include the use of a filter fabric or cloth.

6. Design velocities and depths should be rechecked at all transitions; changes in channel bed slope, or at culverts and bridges.

7. The designer should account for how overland flows will drain into the channel system. Flows that threaten the stabilization technique may require a separate drainage system.

8. Gunite-type stabilization is for the treatment of erosion problems only and should primarily be limited to small drainage swales (generally less than 5-feet wide, 2-feet deep and velocities less than 10-feet per second).

9. Soil cement application.

10. The Town Engineer reserves the right to require a geotechnical investigation.

10. SEDIMENT, SCOUR, LATERAL MIGRATION

10.1 Discussion

Rivers and washes are naturally constantly moving or have a tendency to move laterally and vertically. While this fact is relatively obvious to the trained professional or the perceptive observer, it is a fact that is lost on most individuals mainly due to the time-line involved in these natural tendencies. An eroding bank or wash that migrates is immediately thought to reflect some type of adverse condition that must be stopped. Sometimes, this is the case. However, channel movement, erosion, and deposition are the continuous results of a wash system trying to adjust to natural or man-made changes or in other words a constant tendency toward equilibrium. Understanding and accounting for sediment related issues in design requires more than a quick (and sometimes short-term) fix for a localized problem. It requires an understanding of what the system is doing as well as an understanding of whether the "fix" is going to lead to adjustments and problems elsewhere.

A significant problem the Town continues to face is the deposition of sediment in "at-grade" road crossings. It is anticipated that over time many of these crossings will be replaced with culverts that are designed to be somewhat self-cleaning, or by bridge crossings.

10.2 Channel Trends

For all washes, the designer shall assess whether the channel is stable, or appears to be degrading, or aggrading. Visual observation, along with research of records, can provide some evidence and a basis for historic comparison of channel elevations.

There are also various techniques of estimating equilibrium slopes or providing for sediment transport modeling. However, these techniques are quite specialized and sophisticated and as such, are considered to be outside the scope of this standard design manual. In general, these evaluations should be undertaken by hydraulic engineers or fluvial geomorphologists that have specialized training and experience in sediment transport.

In general, the designer should follow these practices when performing design work within the Town:

1. Provide a narrative discussion of visual trends and other factors that may be impacting the stability of the wash for flows of 1000 cfs or less (for the 100 year event).

2. For washes with a 100-year peak discharge greater than 1000 cfs, a sediment transport model shall be required for any proposed channel modification or bank stabilizing activities unless it can be demonstrated to the satisfaction of the Town Engineer that a sediment Transport model is not warranted.

Sediment transport models may also be required when:

1. The constructed channel will change the natural channel slope.
2. Construction or removal of features and/or vegetation that control the natural channel slope will occur.
3. Excavation of material in the channel bottom.
4. Known areas of active degradation or aggradation are present.
5. A bridge structure is proposed.

3. The design engineer shall evaluate the impacts of their project with respect to sediment loading of any washes within the project area. A statement shall be provided regarding any impacts or lack thereof.

10.3 Scour

Scour, as contrasted with general channel aggradation or degradation, relates to localized erosion induced by some disturbance in stream flow. In natural systems, scour may be induced by a localized change in channel feature such as a fallen rock or a tree at channel transitions; while in constructed systems, scour can occur at bridge piers, along the toe of bank stabilization, or other similar locations. There are many documents that deal with scour, however, publications from the Federal Highway Administration provide a good treatment of these issues. These publications include *HEC-18 Evaluation of Scour at Highway Bridges* (May 2001), *HEC-20 Stream Stability at Highway Structures* (March 2001) and *Bridge Scour and Stream Instability Countermeasures*. In order to aid the designer with identifying potential scour activities, definitions from HEC-18 are presented below:

Total Scour is defined as the sum of the long-term degradation, general (contraction) scour, and local scour.

Degradation (long-term) is a general and progressive lowering of the channel bed due to erosion, over a relatively long channel length.

General Scour is the lowering of the streambed across the stream or waterway at the bridge. This lowering may be uniform across the bed, or non-uniform. That is, the depth of scour may be deeper in some parts of the cross-section. General scour may result from contraction of the flows or other general scour conditions such as flow around a bend.

Contraction Scour, in a natural channel or at a bridge crossing, involves the removal of material from the bed and banks across all or most of the channel width. This component of scour results from a concentration of the flow area at the bridge, which causes an increase in velocity and shear stresses on the bed at the bridge. The contraction can be caused by the bridge or from natural narrowing of the stream channel.

Local Scour is the removal of material from around piers, abutments, spurs and embankments, caused by an acceleration of flow and resulting vortices induced by obstructions to the flow.

The designer should account for scour under the following circumstances:

1. In-channel drop structures or grade control structures.
2. At proposed bridges.
3. At critical areas of channel expansions or contraction.
4. When an obstruction is placed in a wash.(i.e. electrical transmission pole).
5. Downstream of culverts, drainage channels or other outlets if stabilization is not being provided.

10.4 Lateral Migration

Lateral movement of a watercourse can be unexpected and devastating. In the 1983 flood, the Rillito River moved upwards of 1000 feet in places impacting property and leading to the loss of several structures including buildings. The designer shall identify the limits of lateral migration in the design.

The Town will accept the evaluation of a qualified hydraulic engineer or fluvial geomorphologist. Guidelines for this type of analysis can be found in several documents. The City of Tucson Design Manual is one reference as well as State Standard 5-96 *"Water Course System Sediment Balance."*

10.5 Erosion Hazard Setbacks

Erosion hazard setbacks shall be incorporated in the design based on the results of the lateral migration analysis. The designer shall consider bank erosion and incorporate methods and setbacks in accordance with the City of Tucson's "Standards Manual for Drainage Design and Floodplain Management" which include the equations presented in 7.6.1. Other methods may be applied after acceptance by the Town Engineer. When applying allowable-velocity/ tractive-stress/ tractive-power approaches, appropriate geotechnical data, including sieve analyses to determine D_{50}, D_{65}, D_{75}, etc. shall supplement erosion hazard setback determinations.

The following criteria shall apply:

1. Within the zone of lateral migration; buildings, roads, and infrastructure are prohibited unless adequately protected and stabilized to resist erosion. (Does not prohibit stream crossings for roadways and utilities, but lateral migration is to be considered by the designer).

2. Within the zone identified as being 10% wider than the lateral migration zone, buildings are prohibited unless it can be demonstrated that some natural feature such as rock, caliche, or a constructed feature limits lateral migration.

3. Under no circumstances shall the erosion hazard setback be less than 50 feet from an unprotected bank of any regional watercourse, or less than 10 feet from an unprotected bank of any other watercourse.

11. STORMWATER MANAGEMENT (DETENTION)

11.1 Criteria

Table 11-1: Stormwater Detention Criteria

Approach	Parameter	Method	Comment
Volumetric	Storage Volume	Pima County Standards	
Peak Flow	Storage Volume	HEC-1, HEC-HMS	Diversion or Storage Routing
		Rational	See Section 3
Velocity	Outlet Velocity	HEC-RAS, Manning's, etc.	Match Existing, if Feasible (Refer to Section 17-5-2.F.2 in the Oro Valley Floodplain and Erosion Hazard Management Ordinance)

11.2 Purpose

In Oro Valley, Stormwater Management consists of best efforts to balance exiting flows, volumes and velocities through acceptable detention and water harvesting methodologies. Detention is a technique used to mitigate the impact of development on a watershed, whereby peak runoff flows are reduced by a controlled release, normally to a wash system. Water harvesting is a method whereby minor flows are diverted into landscaped depressions, above ground cisterns or underground storage tanks as a means to supplement constructed irrigation systems in support of vegetation. The volume of "harvested" runoff can be applied to the project's overall detention volume requirements.

11.3 Policies

These detention policies are set in place in order to minimize downstream impacts by post developed stormwater discharges. Post-developed stormwater peak discharges and total volumes are generally larger than those flows and volumes of the pre-developed conditions. The downstream impacts will be minimized through the regulation of peak flow rates and total volume discharges. The principal regulatory device is the detention basin which shall be designed to mitigate peak flows and keep these flows at or below pre-developed conditions.

The policy is:

1. For the purposes of hydrologic analysis all basins within the Town of Oro Valley shall be considered as Critical Basins.
2. **RETENTION IS NOT PERMITTED WITHIN THE TOWN OF ORO VALLEY**
3. All new development shall conform to the Pima County Stormwater Detention/Retention Manual volumetric capturing requirements. Detention systems

must be incorporated within all residential developments which are larger than one-half an acre in size and planned for three or more units to one acre, and with all commercial or industrial developments larger than one-half an acre in size. In any case it must be demonstrated that there will be no downstream impact by runoff leaving the site.

4. All new qualifying developments are required to provide Detention Storage Volume for the 2-, 10-, 25-, and 100-year storm events. Computational methods shall comply with the Pima County Detention/Retention Standards for Storage Volume. **In no case are new detention basins allowed to take more than 12 hours to drain free from standing water**. Threshold retention volumes as calculated by Pima County standards shall be metered out of the detention basin at a flow rate of 1 to 3 cfs. Said metering of the threshold volumes shall be accomplished by metered outlet, orifice faced pipe or mechanical means. Infiltration of stormwater is not an accepted method of basin drainage. The time to drain for each storm event is to be indicated within the drainage report.

5. Along with detention thresholds, water budgeting must also be completed and presented in the drainage report. The water budget shall show that down-stream habitat will not be inadvertently starved of its pre-developed conditions runoff resources while providing the detention function for the project

   Water budgets provide a basis for assessing how natural or human-induced change in one part of a hydrologic cycle may affect other aspects of the cycle. As a part of the detention hydrology calculations, water budgeting must be implemented to demonstrate that not only is there an adequate reduction in peak storm water discharge for the developed condition, but that excessive amounts of water are not being withheld through site detention and thus starving down stream habitat.

   Given the relatively short duration and the anticipated size of watersheds under scrutiny, water budget terms need not include evaporation or infiltration.

6. The pre-developed conditions storm water discharge rates for the 2 and 10 year storms match the developed conditions within the following criteria:

   Existing outflow ≥ Developed outflow ≥ 10% max reduction in Existing outflow

7. The developed conditions storm water volume may not be decreased from pre-developed volumes for the 2 and 10 year storm events. An increase in storm water volume may be accepted as long as there are no downstream drainage facilities or properties that would be adversely affected. Pre-approval by the Town Engineer is required for any increase.

8. The developed conditions storm water discharge points and patterns shall be as similar as possible to those of the pre-developed conditions. This “water balancing” approach is intended to preserve, as closely as possible, existing downstream flow characteristics following proposed development

9. In no case shall detention basins discharge to streets.
10. Peak flow rates, volumes and velocities, at any point of concentration leaving the site, cannot exceed and must equal, to the degree possible, the pre-developed flow rates, volumes and velocities for that concentration point for the 2-, 10-, 25-, and 100-year storm events.
11. The Town Engineer may require an increase in detention volume if site conditions warrant it.

11.4 Variance/Detention Waiver

The volumetric storage requirement may be reduced for a negotiated, in-lieu payment to be used by the Town for construction or maintenance of drainage improvements provided the following are met:

1. The project is upstream of an existing or proposed regional drainage structure.
2. The project is directly adjacent to a public wash and the outflow introduced by the development can be demonstrated not to affect the peak flow rate within said wash.
3. The rate of release from the project does not exceed the pre-developed flow rate.
4. Flows can safely be conveyed to a regional outfall or significant and managed conveyance, as defined by the Town Engineer, without causing additional inundation of downstream property.
5. Affected downstream property owners accept, in writing to the Town Engineer, the potential increase in volume, flow, velocity, erosion/deposition of resultant flows.

Detention basins are to be treated as an offline storage facility. Basins shall not be located in washes, and off-site flows are to be kept separate from on-site flows.

The Town Engineer reserves the right to require additional reductions in peak flow rates and volumes in watersheds subject to significant flooding problems. Examples include areas with flooded roadways that influence the ingress and egress to the development, areas that are subject to inundation and evacuation that could limit emergency response to the development, or other similar impacts.

11.5 Design Considerations

The safe design and provisions for maintenance are the responsibility of the design professional and must be demonstrated in the design report. To assist with these measures the following guidelines are provided:

1. The designer should consult the most current Pima County DOT Stormwater Detention/Retention Manual for guidance on layout, safe side slopes, and aesthetic treatments.

2. Landscape plans for basins are to be submitted for review as part of a development plan or preliminary plat.
3. The depth of water in a basin shall be limited to no more than 3-feet in residential areas, school sites, parks or other areas where children might congregate.
4. The depth of basins in non-residential areas (excluding parks and schools) may exceed 3-feet but must be fenced. Stepped retaining walls may be used within fenced areas to eliminate side slopes, however the ability to maintain the basin must be demonstrated.
5. Security barriers must be provided at the top of all basin slopes steeper than 4:1, where water depths exceed two feet:
    a. Barriers may consist of vegetation, masonry, wood, chainlink fence, steel picket guards conforming to building code. A combination of vegetation and structural materials are preferred.
    b. Vegetation shall not be considered an adequate barrier until it has matured and inhibits through pedestrian access. Vegetative barriers must be of a width equal to or greater than overall height, with density sufficient to restrict access.
    c. A minimum 42-inch barrier height is required for all basins.
    d. Barriers are required on any side of a basin where buildings or other restrictive structures are within five feet of the top of side slope, and have no points of exit or entry into the basin area.
    e. Fencing, if required, shall not restrict the hydraulic capacity of the structures.
    f. Guards must be provided, as required by the Town adopted Building Code, for retaining walls on any inlet and outlet structure headwalls and wingwalls, side retaining or cutoff walls.
6. Underground detention storage is allowed provided that:
    a. No buildings are placed over storage.
    b. It is not located within public rights-of-way.
    c. The designer demonstrates that a field life of 50-years can be achieved.
    d. Relatively sediment free water will be getting to the storage tanks or provide a filtration system to collect sedimentation.
    e. Provisions for maintenance are documented.
7. Provisions must be made to prevent velocity damage or clearwater scour damage at outfalls.

8. In-line detention is discouraged and will only be allowed with the prior approval of the Town Engineer

9. First Flush requirements are to be incorporated into all detention basin designs as described in Section 11.7.

11.6 Basin Access and Maintenance Requirements

Thorough, routine maintenance is required to ensure adequate performance for the life of proposed detention basins. The drainage report and landscape plan shall address the following:

1. Access is to be provided to all detention basins and appurtenant structures and facilities. Access is to be clearly delineated on the grading and landscape plans. For basins three feet in depth and greater a vehicle access ramp shall be provided which is suitable in width and construction to safely accommodate heavy equipment. The slope of the access ramp shall not exceed 6:1 (horizontal to vertical) and extend from the top of the basin to the bottom. Vegetation shall not be permitted on the ramp's surface.

2. A graduated marker or story poll, in 0.1 foot increments, is to be provided in all detention basins. Basins are to be cleaned when the marker indicates a sediment depth of 0.5 feet, or once every 24 months, whichever occurs first.

3. Inlet and outlet structures are to be kept free of vegetation and debris at all times.

4. Vegetation irrigation and maintenance schedules shall be provided as an appendix to the drainage report and in tabular or note form on the landscape plan.

5. The maintenance schedule and requirements shall be detailed in private Covenants, Conditions and Restrictions (CC&Rs). The Homeowner's Association (HOA) or responsible party shall be clearly identified within the CC&Rs and shall be responsible for maintenance of basins and basin appurtenances, and maintenance record keeping. Maintenance records shall indicate:

    a. Date of maintenance activities;

    b. Description of maintenance activities;

    c. Depth of sediment as noted on the graduated marker;

    d. Photographs of the basin and appurtenances before and following maintenance activities;

    e. Signature of responsible individual (i.e. HOA President) certifying that the noted maintenance was completed according to the approved schedule and requirements, and that the basin(s) and appurtenances substantially comply with the approved improvement plans; and

    f. Maintenance records shall be retained by responsible party for three years following the most recent maintenance activity. The maintenance records shall be provided to the Town of Oro Valley on a yearly basis.

g. Inspection of the basin and of maintenance records will occur on an annual basis by Town of Oro Valley Stormwater Utility inspector(s) as part of the State ADEQ Permit requirements.

6. Subject to the Town Engineer's written approval, basin maintenance schedules and requirements may be modified following a three-year period of operation. Supporting documentation for such a request is to include, at a minimum:

   a. Past maintenance records and photographs spanning the previous three years (if applicable);

   b. Current photographs of the basin and basin appurtenances;

   c. A written explanation for the request to modify the maintenance requirements.

11.7 First Flush Requirements

11.7.1 Purpose

Pollutants such as sediments and hydrocarbons are constantly being deposited on exposed catchment areas such as parking lot pavements. After becoming deposited, the pollutants become dislodged and carried by stormwater runoff. When a stormwater event occurs, the initial runoff from that event will have carried a greater degree of pollutants than the stormwater run off from later in the event or from subsequent events. The initial rainfall runoff that has cleansed the catchment now contains a high pollutant load and is referred to as the "first flush".

First flush collection systems are employed to capture and isolate the most polluted portions of runoff with subsequent cleaner portions of runoff being diverted directly to the stormwater system. In addition the first flush collection systems will help ensure our storm water runoff meets the State of Arizona Surface Water Quality Standards (AAC Title 18 Chapter 11 DEQ, Water Quality Standards) that include:

"A surface water shall be free from pollutants in amounts or combinations that:

- Settle to form bottom deposits that inhibit or prohibit the habitation, growth , or propagation of aquatic life or that impair recreation uses (bottom deposits standard);
- Cause objectionable odor in the area in which the surface water is located;
- Are toxic to humans, animals, plants or other organisms, (toxics standard);
- Cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth, or propagation of other aquatic life or that impair recreational uses (narrative nutrient standard)
- Change the color of the surface water from the natural background levels of color."

Surface water shall be free from oil, grease, and other pollutants that float as debris, foam, or scum; or cause a film or iridescent appearance on the surface of the water; or cause a deposit on a shoreline, bank, or aquatic vegetation.

Also, the Canada Del Oro Wash is designated by the Arizona Department of Environmental Quality as an ephemeral aquatic and wildlife surface water (A&We). Any

discharge into a watercourse that impacts the Canada Del Oro Wash, Big Wash and the Rillito Wash should meet all the requirements for A&We, Partial Body Contact, and Agricultural Livestock identified in the State Water Quality Standards for surface waters with these designations. (AAC Title 18 Chapter 11).

11.7.2 Criteria

Oro Valley's First Flush requirement can be addressed by treating the required volume of storm water directly captured by parking lot paved surfaces. This required volume shall be calculated by the first ½-inch of runoff over the entire parking lot paved surface. Thus the minimum First Flush volume is calculated as follows:

$V = (0.5 \text{ in}/12) \times A$

Where: V = First Flush Volume, in AC-Ft

A = Area of paved parking lot surface, including PAAL's, in Acres.

In-lieu of calculating volume of First Flush for treatment, flow rate may be applied. The flow rate to be treated for First Flush shall be the sub-watershed basin stormwater outflow created by parking lot paved surfaces during a 2-year, 1-hour storm.

11.7.3 Design

The designer may opt to either treat First Flush offline, upstream of a detention system, or downstream of a detention system. Whichever approach best fits the project site, the designer is encouraged to meet with Town engineering staff to discuss location and type of treatment method(s). First Flush treatment systems must be acceptable to the Town Engineer. Pre-submittal discussions between Town staff and the designer can identify acceptable treatment systems prior to submission of the drainage report. The Town prefers the utilization of hydrodynamic separation such as Vortechs chambered technology or equal.

First Flush treatment can be accomplished using a variety of differing technologies but must be able to remove 80% of the total suspended solids from the influent and the effluent will be free from oils and greases with no ongoing or recurring visible sheen. In addition, the first flush device will be capable of removing all water quality pollutants to the level prescribed in the Arizona Department of Environmental Quality numeric water quality standards for the Aquatic and Wildlife (ephemeral), Partial Body Contact (PBC), and Agricultural Livestock Watering (AgL) designations where applicable. If determined to be not applicable, a specific statement identifying compliance with these pollutants in the effluent discharge levels from the first flush devices is required.

Documentation acceptable to the Town Engineer to support the removal efficiencies of the proposed technology is required.

11.7.4 Access and Maintenance

Thorough, routine maintenance is required to ensure adequate performance for the life of proposed treatment systems. The drainage report shall address the following:

1. Access is to be provided to all First Flush treatment systems and appurtenant structures and facilities. Access is to be clearly delineated on the grading and paving plans.

2. Manufacturer's maintenance recommendations.
3. Inlet and outlet structures are to be kept free of vegetation and debris at all times.
4. The maintenance schedule and requirements shall be detailed in private Covenants, Conditions and Restrictions (CC&Rs). The Homeowner's Association (HOA) or responsible party shall be clearly identified within the CC&Rs and shall be responsible for maintenance of treatment systems and appurtenances, and maintenance record keeping. Maintenance records shall indicate:
    a. Date of maintenance activities;
    b. Description of maintenance activities;
    c. Photographs of the treatment systems and appurtenances before and following maintenance activities;
    d. Signature of responsible individual (i.e. HOA President) certifying that the noted maintenance was completed according to the approved schedule and requirements; and
    e. Maintenance records shall be retained by responsible party for three years following the most recent maintenance activity. The maintenance records shall be provided to the Town of Oro Valley on a yearly basis.
5. Approved systems are not to be altered without written approval by the Town Engineer (i.e. filter inserts cannot be removed or replaced with substitute filters without prior written approval from the Town Engineer). Subject to the Town Engineer's written approval, First Flush treatment system maintenance schedules and requirements may be modified following three years from initial construction. Supporting documentation for such a request is to include, at a minimum:
    a. Past maintenance records and photographs spanning the previous three years (if applicable);
    b. Current photographs of the treatment system and appurtenances;
    c. A written explanation for the request to modify the maintenance requirements;
    d. Manufacturer's concurrence with the proposed modifications.

11.8 Water Harvesting

11.8.1 Purpose

Rainwater harvesting is defined as intercepting, catching, storing, diverting or directing storm water runoff from roofs, parking areas, etc. during rain events and putting it to beneficial use. The primary recipient of water harvesting is site landscaping.

11.8.2 Criteria

Water harvesting shall be utilized to offset the resource demand placed on the public water supply used for irrigation of site landscaping. Water harvesting may be accomplished by the application of passive or active collection systems.

1. Types of Systems

a. Passive System:

   Diverts or directs rainwater runoff to appropriate locations where it is collected and allowed to infiltrate the soil naturally. This system contains no long-term storage capabilities.

b. Active System:

   This type of system employs a reservoir or other water storing apparatus to catch and store rainwater for later use with conventional landscape irrigation systems. It typically involves electric pumps and valves, and will be cross-connected to the site irrigation system.

2. Water Budgeting

Water budgeting shall be in accordance with the criteria set forth in section 11.3.5. Reductions in detention requirements will not affect the overall site water budget requirements.

3. Standing Water

   a. Standing water for passive water harvesting systems must infiltrate or dissipate within 12 hours of initial ponding.

   b. Active water harvesting systems by definition shall be able to store water for future use. All active water harvesting storage systems must be enclosed, covered and mosquito proof.

4. Water quality

   All water collected and utilized for water harvesting from parking lots must meet the same discharge quality as stipulated within section 11.7 – First Flush.

5. Reduction in Detention

   Detention volume may be reduced at a 1:1 volumetric ratio to the volume utilized for water harvesting. This volumetric ratio must be confirmed for the 2-, 10-, 25- and 100–year storm events.

11.8.3 Design

Water harvesting basins and facilities shall be designed such that they easily and practically facilitate the use of stormwater runoff to supplement other sources of water in maintaining natural and landscaped vegetation..

1. The maximum depth of any open water harvesting basin shall be 4”.
2. Water harvesting basins may be combined with site detention basins provided that the residual ponding will dissipate within 12 hours. This shall be demonstrated by a combination of percolation, evapotranspiration and positive outflow device such as a metered pipe. At a maximum, a positive outflow pipe shall be installed no higher than 4” above the basin invert.
3. All open landscape areas graded less than 1.0% positive outflow slope shall be considered water harvesting areas and be subject to the access and maintenance criteria set forth in section 11.8.4

4. No passive water harvesting areas shall be allowed within 10 feet of a building or vertical structural element greater than 4' in height without special structural consideration and design approved by the Town Engineer and the Town Building and Safety Director.
5. All active water harvesting systems which connect to a potable water supply must have backflow protection installed and meet the requirements of Article 15-23 of the Town Code: Backflow Prevention and Cross-Connection Control Program.
6. All rainwater harvesting shall also comply with the provisions set in the Town of Oro Valley Zoning Code, Section 27.6.D.4.
7. As a reference, refer to the City of Tucson's Water Harvesting Guidance Manual, Ordinance Number 10210, for design techniques and information. The use of the techniques contained within this manual are subject to the design parameters set within this section of the Drainage Criteria Manual.

11.8.4 Access and Maintenance

Thorough, routine maintenance is required to ensure adequate performance for the life of proposed water harvesting facilities. The drainage report and landscape plan shall address the following:

1. Access is to be provided to all water harvesting basins, appurtenant structures and facilities. Access is to be clearly delineated on the grading and landscape plans. The access shall be located so as to provide minimal disturbance to the site vegetation.
2. Inlet and outlet structures are to be kept free of vegetation and debris at all times.
3. Vegetation irrigation and maintenance schedules shall be provided as an appendix to the drainage report and in tabular or note form on the landscape plan.
4. The maintenance schedule and requirements shall be detailed in private Covenants, Conditions and Restrictions (CC&Rs). The Homeowner's Association (HOA) or responsible party shall be clearly identified within the CC&Rs and shall be responsible for maintenance of basins and water harvesting appurtenances, and maintenance record keeping. Maintenance records shall indicate:
    a. Date of maintenance activities;
    b. Description of maintenance activities;
    c. Photographs of the basin and appurtenances before and following maintenance activities;
    d. Signature of responsible individual (i.e. HOA President) certifying that the noted maintenance was completed according to the approved schedule and requirements, and that the basin(s) and appurtenances substantially comply with the approved improvement plans; and
    e. Maintenance records shall be retained by responsible party for three years following the most recent maintenance activity. The maintenance records shall be provided to the Town of Oro Valley on a yearly basis.
5. Subject to the Town Engineer's written approval, basin maintenance schedules and requirements may be modified following a three-year period of operation. Supporting documentation for such a request is to include, at a minimum:

a. Past maintenance records and photographs spanning the previous three years (if applicable);

b. Current photographs of the basin and basin appurtenances;

c. A written explanation for the request to modify the maintenance requirements.

12. ENVIRONMENTAL REGULATORY COMPLIANCE

12.1 Riparian Zone Management Ordinance

If the property contains riparian areas as defined under the Town of Oro Valley's Riparian Zone Management Ordinance, or has areas otherwise designated by the Town as environmentally sensitive, the applicant shall provide adequate erosion and sediment control measures to protect the identified areas from sedimentation due to their activities. The guidelines supplied in the National Pollutant Discharge Elimination System (NPDES) section of this Manual and the Town's Grading Ordinance shall be utilized to develop proper control measures. **These measures shall be applied to all parcels, including parcels not covered under the current NPDES regulations.**

12.2 Erosion Control Measures

The applicant shall provide applicable erosion control measures as described under the Storm Water Pollution Prevention Plan (SWPPP) section in Appendix A – (Construction SWPPP Checklist) for all sites, including those that do not require NPDES authorization. Documentation shall include:

1. For projects **not requiring** authorization under the ADEQ Construction General Permit (CGP) and Section 402 of the Clean Water Act, the applicant shall submit the following plan.

    a. All stormwater control measures shall appear and shall be described on the site grading plan.

    b. Use arrows to show the direction(s) where stormwater will flow for all areas within the project limits (This is for the period of construction, not just the final contours. Flow direction may change as project grading progresses; when this occurs, map(s) are to be updated).

    c. Show areas of soil disturbance and special areas not to be disturbed.

    d. Show and identify all structural BMPs utilized.

    e. Show locations where and identify stabilization Best Management Practices (BMPs).

    f. Show locations of on-site material storage, waste storage or receptacles, borrow areas, equipment storage or other supporting activities.

    g. Identify any water bodies (including dry washes and wetlands) on the site.

    h. If there are no water bodies, indicate this on the map.

i. Identify any areas of the site where final stabilization has been achieved.

2. For projects **authorized** under the ADEQ Construction General Permit (CGP) and in compliance with the **EPA's Section 402 of the Clean Water Act – National Pollutant Discharge Elimination System (NPDES)**, the applicant shall supply the following to the Oro Valley Department of Public Works:

   a. Copy of completed ADEQ NPDES Notice of Intent (NOI) Application Letter.

   b. Copy of the SWPPP as required under the CGP. The SWPPP should include a list of Best Management Practices (BMPs) planned for the project, the location of sediment control devices, a revegetation and/or soil stabilization plan, and an implementation and maintenance plan for the SWPPP. The SWPPP is to demonstrate construction, post-construction and good housekeeping measures. Specific BMPs can be obtained from the *California Stormwater Best Management Practices Handbook*, EPA's "National Point Discharge Elimination System Construction Site Stormwater Runoff Control" as well as from Pima County Flood Control District, Arizona Department of Transportation and the Town of Oro Valley.

      Any SWPPP's not meeting the criteria set forth within the ADEQ CGP, Permit No. AZG2008-001 shall be returned to the applicant for correction. No grading construction activities shall be allowed until the SWPPP has been accepted by the Town, the NPDES NOI accepted by ADEQ and the SWPPP measures are in place.

   c. All SWPPP's submitted to the Town of Oro Valley shall conform to the form and structure as represented within the ADEQ 2008 Construction General Permit SWPPP Guidance Checklist, provided in appendix A of this manual. A copy of the completed checklist shall be attached to all SWPPPs submitted to the Town.

   d. A copy of the ADEQ CGP certificate authorizing permit coverage.

   e. A copy of the current Notice Of Intent (NOI) for Construction Activity Discharges to Waters of the United States.

3. For projects **requiring authorization** under the ADEQ Multi-Sector General Permit (MSGP) and in compliance with the **EPA's Multi-Sector General Permit**, the applicant shall supply the following to the Oro Valley Department of Public Works:

   a. Proof of registration of the facilities with ADEQ.

   b. Copies of all documentation submitted to ADEQ, including but not limited to SWPPP(s), NOI(s), BMP(s), etc.

c. Documentation of industrial activities Standard Industrial Classification (SIC) Codes.

4. For projects requiring an Individual NPDES permit, The applicant shall coordinate with the Town of Oro Valley for documentation requirements, but at a minimum shall supply the complete EPA/ADEQ permit application package and specific requirements of the Individual Permit. If the permit is not issued at the time of submittal to the Town of Oro Valley, the applicant shall provide the information when issued.

Additional information regarding Best Management Practices (BMPs) or other requirements of the NPDES program can be obtained from the following organizations:

Town of Oro Valley

11000 N. La Canada Drive
Oro Valley, Arizona 85737
520-229-4800

ADEQ

Southern Regional Office
400 West Congress; Suite 433
Tucson, Arizona 85701
520-628-6733
http://www.azdeq.gov/environ/regional/sro/

USEPA Region 9

Water Management Division WTR-5
Stormwater Staff
75 Hawthorne Street
San Francisco, CA 94105
http://www.epa.gov/region09

USFWS

Arizona Ecological Services Field Office (AESFO)
2321 W. Royal Palm Road
Suite 103
Phoenix, AZ 85021
602-640-2720
http://www.fws.gov/southwest/es/arizona/

Tucson Sub-office (AESFO)

201 N Bonita
Suite 141
Tucson, AZ 85745
520-670-6144

Electronic Filing:

Electronic copies of NOI, NOT and other forms can be obtained at *http://www.azdeq.gov/functions/forms//appswater.html.* Notices of Intent and NOTs may be filed electronically at *http://az.gov/webapp/noi/main.do* or *http://www.azdeq.gov* and following the "Water" link under "Key Topics", click on "Smart NOI".

Review and Enforcement

The SWPPP permitting process is described by ADEQ's at http://www.azdeq.gov/environ/water/permits/overview.html. A full, downloadable copy of their "Compliance and Enforcement Handbook" can be found at *http://www.adeq.gov/function/forms/download/handbook/fullhandbookw.pfd*.

12.3 Sections 404/401 of the Clean Water Act

The Town of Oro Valley does not enforce compliance with sections 404 and 401 of the EPA's Clean Water Act. However, if perceived infractions to these sections of the Clean Water Act are observed by Town staff, the Town reserves the right and has an obligation to contact the United States Army Corps of Engineers (USACOE) to report said activities.

Section 404 of the CWA is a Federal program designed to regulate "the discharge of dredged or fill materials into waters of the United States". Individual and general permits are reviewed by the USCOE. Individual permits apply to projects which may result in significant impacts while general permits involve minimal adverse impacts.

Section 401 addresses "associated chemical, physical and biological impacts such as low dissolved oxygen levels, turbidity, inundation of habitat, stream volume and fluctuations, filling of habitat, impacts on fish migration, and loss of aquatic species as a result of habitat alterations."

Information can be obtained from;

U.S. Army Corps of Engineers (ACOE)

Los Angeles District Office:
PO Box 532711
(915 Wilshire Blvd. Suite 1101)
Los Angeles, Ca.
90053-2325
(90017)
213-452-3908

ACOE Local Tucson Office:
5205 E. Comanche St.
#1605
Davis Monthan, Az.
520-670-6277

Arizona Department of Environmental Quality (ADEQ)

400 West Congress; Suite 433
Tucson, Arizona 85701
520-628-6733

ADEQ – Phoenix Office

1110 W. Washington St.
Phoenix, Arizona 85007
602-771-2300 or 800-234-5677

REFERENCES

Arizona Department of Transportation. *Highway Drainage Design Manual, Hydrology,* Report Number: FHWA-AZ93-281, Final Report March 1995.

Arizona Department of Water Resources, *State Standard for Watercourse Bank Stabilization,* SS 7-98, May 1998.

Arizona Department of Water Resources, *State Standard for Watercourse System Sediment Balance,* SS 5-96, September 1996.

Federal Emergency Management Association, *Flood Insurance Study, Pima County, Arizona and Incorporated Areas, Volume 1, 2, and 3 of 3*, Revised: February 8, 1999.

Federal Highway Administration, *Hydraulic Design of Highway Culverts*, Hydraulic Design Series No. 5, Report Number: FHWA-IP-85-15, Reprinted 1998.

Federal Highway Administration, *Evaluating Scour at Bridges*, Fourth Edition, Hydraulic Engineering Circular No. 18, Report Number: FHWA-NHI-01-001, May 2001.

Federal Highway Administration, *Stream Stability at Highway Structures*, Third Edition, Hydraulic Engineering Circular No. 20, Report Number: FHWA-NHI-01-002, March 2001.

Flood Control District of Maricopa County, Engineering Division, *Drainage Design Manual for Maricopa County, Arizona Volume I Hydrology*, 1995.

Kimley-Horn and Associates, *Draft Town of Oro Valley Drainage Criteria Manual.*

Pima County Department of Transportation and Flood Control District, *Hydrology Manual for Engineering Design and Floodplain Management within Pima County, Arizona,* September 1979 (Revised February 1981).

Pima County Department of Transportation, *Pima County Storm Drain Design Guidelines and Standard Plans,* March 23, 1981.

Simons, Li & Associates, Inc., *Data Collection Summary Report for the Tucson Stormwater Management Study, Phase II Stormwater Master Plan (Task 4, Subtask 4.4 & 4.13),* October 14, 1993 (Revised November 1995).

Simons, Li & Associates, Inc., *Existing-Conditions Hydrologic Modeling for the Tucson Stormwater Management Study, Phase II Stormwater Master Plan (Task 7, Subtask 7A.3),* December 17, 1995 (Revised November 1995).

Simons, Li & Associates, Inc., *Final Report, Tucson Stormwater Management Study, Phase II, Stormwater Master Plan (Task 11)*, December 1995.

Simons, Li & Associates, Inc., *Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona,* February 1989.

Soil Conservation Service *Urban Hydrology for Small Watersheds, Technical Release 55,* June 1986.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, *HEC-1 Flood Hydrograph Package User's Manual*, Version 4.0, September 1990.

United States Department of Agriculture Soil Conservation Service, *General Soils Map, Pima County, Arizona,* March 1974 (Reprinted July 1980).

United States Department of Agriculture Soil Conservation Service, S*oil Survey of Pima County, Arizona Eastern Part, Draft Copy*, Current Draft Undated.

United States Department of Agriculture Forest Service, General Ecosystem Survey, Copies of select pages, Letter dated September 8, 2000

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practices, U.S. EPA, 1992

Above citation and A Current Assessment of Urban Best Management Practices, Metropolitan Washington Council of Governments, March 1992

United States Environmental Protection Agency, *Wetland Regulatory Authority*

United States Environmental Protection Agency, *Section 401 Certification and Wetlands*

United States Department of Agriculture, Natural Resources Conservation Service, *National Engineering Handbook, Part 360, Chapter 7, Hydrologic Soil Groups*

TOV Water Harvesting Handbook.

APPENDIX A – CONSTRUCTION SWPPP CHECKLIST

2008 Construction General Permit SWPPP Guidance Checklist

This optional checklist is provided to assist owners and operators in preparing their AZPDES Stormwater Pollution Prevention Plan (SWPPP) to meet the requirements of Arizona's 2008 Construction General Permit (AZG2008-001). The "Descriptions" provided below do not necessarily reflect the exact wording used in the permit; rather these are stated in simplified language to provide additional guidance. (Note if any inadvertent conflict exists between this document and the permit, the permit language prevails). The "Permit Citation" column shows you where each particular requirement is found in the 2008 CGP. Use the "Location" column to note the page where the requirement is addressed in your SWPPP. Please leave the "For ADEQ Use Only" column blank. Using this SWPPP checklist will help you ensure that all the permit requirements are addressed in your SWPPP and will also assist the Department in conducting a more efficient review of your SWPPP if it is required to be submitted.

Please note that your SWPPP does not have to follow the format of this checklist; the purpose of this checklist is only to ensure that your SWPPP contains all required components. While this checklist is intended for use in preparing your initial SWPPP, your SWPPP is a "living" document and it is important that it be updated to document changes in your project, best management practices (BMPs), Inspections, and other pertinent information.

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
	OPERATOR RESPONSIBILITIES		
Part III.A.2.d	Identify who is responsible for on-site SWPPP implementation		
Part III.B.2.a.	Indicate or show the areas of the project where the operator has control over project specifications, including the ability to make changes in specifications		
Part III.B.2.a	Provide name(s) of the person(s) who have day-to-day control over construction plans and specifications		
Part III.B.2.b	Identify who is responsible for installing, implementing, and maintaining the BMPs in the plan		
Part III.B.2.b	Identify or show the areas of the project where each operator has control over day-to-day activities		
Part III.B.2.b	Provide name(s) of the person(s) having control over project specifications, including the ability to make changes in specifications		
Part III.C.1	Provide the name and contact information for all operators and indicate the areas of the project each operator controls		
	PROJECT DESCRIPTION		
Part III.A.2.a	Identify all potential sources of pollutants/pollution from construction activities that could possibly contact stormwater		
Part III.C.2.	Describe the construction activity (what is being built, what is being disturbed, how long it is expected to take, etc.)		
Part III.C.2.a	Describe the project and what it will be used for when completed (after Notice of Termination (NOT) is filed)		

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
Part III.C.2.b	Describe the planned phasing or sequencing of land disturbance activities. The amount of open/disturbed dirt left open at one time should be minimized where possible		
Part III.C.2.c	Indicate the **total** acres of the site and number of acres that will be **disturbed** (include off-site borrow and fill area, staging and equipment storage areas)		
Part III.C.2.d	Indicate the percentage of the site that is impervious (e.g., paved, roofed, etc.) **before** and **after** construction		
Part III C.2.e	Describe the soil (e.g., sand, clay, etc.) at the site and its potential for erosion (Suggestion: reference the Soil Survey covering the project site prepared by the U.S. Department of Agriculture, Natural Resource Conservation Service for soil information http://soils.usda.gov/survey/)		
Part III.C.2.f	Include a map showing the project location (e.g. U.S.G.S. quadrangle, portion of a city or county map). The map must also show any washes or other waterbodies within 1 mile of the site		
Part III.C.4	Identify the nearest receiving water(s). A receiving water is a natural watercourse into which stormwater would flow in a storm event and includes dry washes, streams, tributaries, and other waters of the U.S. (such as designated canals). Man-made structures such as retention basins, storm sewer systems, or city storm drains are not receiving waters.		
Part III.C.4	Identify the areal extent where soils may be disturbed and show any wetlands near the site that could receive dirt or run-off from the construction activity		
Part III.C.6	Describe any pollutant sources from areas other than dirt moving (e.g., dedicated concrete and asphalt plants, fueling operations, material or waste storage etc. that are associated with the construction project). Identify where these sources are or will occur on site		
	SITE MAP (note multiple maps may be used) All the following are to be shown on the site map or maps		
Part III.C.3.	Include a site map completed to scale		
Part III.C.3.a.	Use arrows to show the direction(s) where stormwater will flow for all areas within the project limits (This is for the period during construction, not final contours. Flow direction may change as project grading progresses; when this occurs, maps are to be updated.)		
Part III.C.3.b.	Show areas of soil disturbance **and** areas that will not be disturbed		
Part III.C.3.c.	Show all structural BMPs identified in the SWPPP		
Part III.C.3.d.	Show locations where stabilization BMPs are expected to occur		
Part III.C.3.e.	Show locations of on-site material storage, waste storage or receptacles, borrow areas, equipment storage or other supporting activities		

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
Part III.C.3.f.	Identify any water bodies (including dry washes and wetlands) on the site. If there are no water bodies, indicate this on the map		
Part III.C.3.g.	Show locations where stormwater discharges to surface water (including wetlands, ephemeral waters and dry washes) and to municipal storm sewer systems (MS4s) (use an "X" to indicate discharge location(s)). Where surface waters and/or MS4s receiving stormwater do not fit on the map, use arrows to show the direction and indicate the approximate distance to the surface water and/or MS4		
Part III.C.3.h.	Show the location and registration number of all onsite dry-wells and dry-wells located on adjacent properties that could receive stormwater from the site (if none exist, indicate that)		
Part III.C.3.i.	Identify any areas of the site where final stabilization has been achieved		
Part III.C.3.j	Specify existing vegetated areas (trees, brush, etc.) and boundaries of environmentally sensitive areas and buffer zones that are to be preserved		
	BMP (Best Management Practices) REQUIREMENTS		
Part III.A.2.b, III.C.5.a, and IV.A.1	Identify BMPs selected for the site and describe how each will reduce pollutants in stormwater		
Part III.C.5.b	Describe how BMPs will be added, modified, or replaced for each phase or sequence of construction activities. Also, identify which operator is responsible for the implementation of BMPs		
Part III.C.5.c	Provide drawings and/or specifications of structural BMPs that include design or installation details		
Part IV.B.1.a	Describe where natural/existing vegetation will be preserved. Locations of trees and boundaries of environmentally sensitive areas and buffer zones to be preserved are also to be on the SWPPP site map		
Part IV.B.1.b	If using seed to revegetate, provide the mixture and application specifications. (These may be obtained from product provider)		
Part IV.B.1.c	If culverts are present on-site, describe measures that will be used to minimize erosion at and around the culvert(s)		
Part IV.B.1.d	Describe how off site stormwater that may run onto the project site will be diverted or otherwise managed with on-site engineering controls, containment, or BMPs		
Part IV.B.3.a.	Identify how records of dates when major grading activities occur will be kept		
Part IV.B.3.b.	Identify how records of when construction activities temporarily or permanently cease on all portions of the site will be kept		
Part IV.B.3.c.	Identify how records of when stabilization measures are initiated and completed and reason(s) for delay will be kept		

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
Part IV.C.3	Provide sizing criteria and show calculations for sediment basin(s) and indicate whether basin(s) will be temporary or permanent (i.e., post-construction)		
Part IV.C.3	Provide reason(s) or rationale why a sediment basin was determined to **not** be possible at the project site (If applicable)		
Part IV.D.3.	Describe the location(s) and how materials will be stored or staged both on-site and offsite; including overburden, soil stockpiles, and borrow areas		
Part IV.E.2.	Identify and provide the location(s) of all non-stormwater discharges allowed by this permit expected to be associated with the project and describe BMPs used to minimize discharge of pollutants		
Part VI.B.1	Describe measures for preventing and responding to spills, including spill notification requirements		
	POST-CONSTRUCTION CONTROLS		
Part IV.F.1.	Identify post-construction stormwater BMPs (e.g., porous pavement, open space preservation, etc.) that will be installed as part of this project. Note: temporary BMPs (e.g., straw waddles, etc.) must be removed prior to submitting your Notice of Termination		
	INSPECTIONS		
Part IV.H.1	Identify the minimum inspection frequency as well as goals for more frequent inspections		
Part IV.H.2.	Provide name, title, and qualifications of person(s) who will be conducting inspections		
Part IV.H.3.a	Describe how inspection of the following items will be conducted:		
	Good housekeeping BMPs (e.g., solid waste storage and pickup; chemical storage, use, and cleanup; fueling; etc.)		
	Erosion and sediment control BMPs		
	Construction site entrance and egress location(s) including looking for evidence of sediment, debris, and other pollutants tacked offsite onto paved surfaces (e.g., streets, sidewalks, parking lots, etc)		
	Municipal storm sewer systems, including streets, inlets, etc. which can be observed at ground level. Should focus on discharge (and potential for discharge) and accumulation of sediment, trash, and other pollutants		
	Observation and assessment of accessible discharge locations to determine if erosion control BMPs are adequate and effective in reducing discharge of sediments		
	For discharge points that are inaccessible, inspection of downstream locations should occur, where practicable		
Part IV.H.3.b	Describe how inspections will be documented (note: inspection reports must be added to the SWPPP in chronological order, Permit Part IV.H.4)		
Part IV.H.3.c	Describe procedures for repairing, replacing, and/or supplementing nonfunctional and underperforming BMPs (see Permit Part IV.I.2)		

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
	INSPECTION REPORT		
Part IV.H.4	Provide a copy of the inspection report form to be used to document site inspections. At a minimum, the report form must include the following information (note, an example form is provided in the permit and may be used to satisfy this permit requirement):		
	Date of inspection		
	Name and title of person(s) conducting the inspection		
	Information about weather conditions since the last inspection, including: best estimate of the beginning and end of each rain event; time elapsed since last rain event; and approximate amount of rainfall for each event (in inches)		
	Locations where sediment and other pollutants are or were discharged from the site		
	For inspections conducted while stormwater can be observed discharging from the site, provide a description of the physical characteristics (e.g., presence of suspended sediment, turbid water, discoloration, oil sheen, etc.)		
	Location and identification of BMPs in that need to be maintained, failed to operate, or proved inadequate		
	Location(s) where additional BMPs are needed that did not exist at the time of inspection		
	Identification of all sources of non-stormwater and the associated pollution prevention control BMPs		
	Identification of material storage areas and evidence of or potential for pollutant discharge from such areas		
	Corrective actions required, including any changes to SWPPP necessary, and implementation dates (of corrective actions/maintenance, and SWPPP changes)		
	Identification of any non-compliance with the conditions of this permit, or where the inspector does not identify any incidents of non-compliance, the inspection report shall contain a certification that the construction project or site is being operated in compliance with the SWPPP and permit		
	Certification statement and signature for inspection report in agreement with Part VIII.J.		
	MONITORING PLAN - (if applicable)		
Part III.C.6	If discharging to an impaired water, identify sources of pollutants of concern listed on the 303(d) list that may be potentially discharged through construction site activities and soil disturbances. If these exist, describe added or better BMPs to minimize discharges of these pollutants		
Part V.B.1	For projects located within ¼-mile of a unique or impaired water, your SWPPP must include a Monitoring Plan that (at a minimum) contains the following information		
	Specific location(s) at the site where visual and analytical monitoring activities will be conducted		

Permit Citation	Description	Location in SWPPP & Notes	For ADEQ Use Only
	The name(s) and titles of the person(s) who will perform the monitoring		
	Map showing the segments or portions of the receiving water (stream, lake, etc.) that are most likely to be impacted by the discharge of pollutant(s)		
	Water quality parameters/pollutants to be sampled		
	The citation and description of the sampling protocols to be used (should include Standard Operation Procedure for sample collection, preservation, etc.)		
Part V.B.1, continued	Identify analytical methods and related method detection limits (if applicable) for each parameter to be monitored		
	Identify any special pollutants of concern based on the most recent 305(b)/303(d) listing or other information available		
	Describe the potential sources of this pollutant from the project, if any (including disturbances of soil containing this pollutant)		
Part V.D.3	If the unique or impaired water is a lake, your monitoring plan (including monitoring locations) must be submitted to and approved by the Department		
Part V.D.5	Chain-of-custody (COC) forms including: sampler's name, phone number, date and time of sample collection, sample identification, requested analysis, and project name or number		
	ADMINISTRATIVE		
Part III.A.3 Part VIII.J.2	Ensure the SWPPP is signed by a person meeting the certification requirements of Permit Part VIII.J		
Part III.D.1	Include a copy of AZPDES permit (AZG2008-001) with the SWPPP		
Part III.D.2	Include a copy of the completed NOI form that was submitted to ADEQ		
Part III.D.3	Include a copy of the authorization certificate received from ADEQ		
Part III.D.4	Identify any city or county which received a copy of the authorization certificate		
Part III.D.5	Include copies of other agreements with any state, local or federal agencies that would affect the provisions or implementation of the SWPPP, **if** applicable (404 permits, local grading permits, etc.)		

APPENDIX B – TOV FLOODPLAIN ORDINANCE

Chapter 17
FLOODPLAIN AND EROSION HAZARD MANAGEMENT

Articles:

Article 17-1
STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND METHODS

Sections:

17-1-1 Statutory Authorization

The Legislature of the State of Arizona has, in ARS §48-3610, enabled the Town of Oro Valley to adopt regulations in conformance with ARS §48-3603 that are designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the Town Council of Oro Valley, Arizona, does ordain as follows.
((O)05-35, Enacted, 10/05/2005)

17-1-2 Findings of Fact

A. The flood hazard areas of Oro Valley are subject to periodic inundation that may result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

B. These flood losses are caused by the cumulative effect of obstructions in the regulatory floodplain, which increase flood heights and velocities. Also, when these obstructions are inadequately anchored, they may cause damage in other areas. Uses that are inadequately flood-proofed, elevated or otherwise protected from flood damage also contribute to the flood loss.
((O)05-35, Enacted, 10/05/2005)

17-1-3 Statement of Purpose

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

A. To protect human life and health;

B. To minimize expenditure of public money for costly flood control projects;

C. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

D. To minimize prolonged business interruptions;

E. To minimize damage to public facilities and utilities such as water and gas mains,

electric, telephone, and sewer lines, and streets and bridges located in the regulatory floodplain;

F. To help maintain a stable tax base by providing for the protection of regulatory floodplain and erosion hazard areas;

G. To insure that potential buyers are notified that property is in a regulatory floodplain;

H. To insure that those who occupy an area in a regulatory floodplain assume responsibility for their actions; and

I. To maintain eligibility for disaster relief.

((O)05-35, Enacted, 10/05/2005)

17-1-4 Methods of Reducing Flood Losses

In order to accomplish its purposes, this ordinance includes methods and provisions for:

A. Restricting or prohibiting uses which are dangerous to the public health, safety, and welfare as well as public and private property, due to water or development hazards; or which result in increased damages to development or increases in flood heights or velocities;

B. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of start of construction;

C. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help to accommodate natural flood storage potential or the channelization of floodwaters;

D. Controlling filling, grading, dredging, and other development that may increase flood damage; and

E. Preventing or regulating the construction of flood barriers that unnaturally divert floodwaters, or that may increase flood hazards in other areas.

Article 17-2
DEFINITIONS

17-2-1 Definitions

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted to give them the meaning they have in common usage, and to give this ordinance its most reasonable application.

Alluvial Fan means a geomorphologic feature characterized by a cone or fan-shaped deposit of boulders, gravel and fine sediments that have been eroded from mountain slopes, transported downstream by flood flows, and then deposited on valley floors, and that is subject to flash flooding, high velocity flows, debris flows, erosion, sediment movement, deposition, and channel migration.

Alluvial Fan - Inactive means an alluvial fan where floodwaters typically flow within incised channels, and adjacent lands are stable.

Alluvial Fan Flooding means flooding occurring on the surface of an alluvial fan, or similar landform, which originates at the apex; and is characterized by high-velocity flows; active processes of erosion, sediment transport, deposition, and unpredictable flow paths.

Alluvial Fan High Hazard Area (AFHH) means an area of active alluvial fan flooding that is reserved to convey and receive sediment and floodwater without altering, and thereby potentially increasing, the distribution of flood hazards across the fan to otherwise inactive areas and areas located down slope.

Apex means a point on an alluvial fan, or similar landform, below which the flow path of the major stream that formed the fan becomes unpredictable, and alluvial fan flooding can occur.

Appeal means a request for a review of the decision of the Floodplain Administrator or Town Engineer concerning previous determinations or actions, pursuant to this chapter. Appeals are heard and decided by the Floodplain Board.

Area of Shallow Flooding means a Federal Emergency Management Agency (FEMA) designated Zone "A" or Zone "X" area depicted on a Flood Insurance Rate Map (FIRM) for the community, or an area identified on a Flood Hazard Boundary Map that has, on an annual basis, a one percent or greater chance of flooding to an average depth of one-half foot, or

greater, during the occurrence of a base flood at locations where a clearly defined channel does not exist and the path of the flooding is often unpredictable and indeterminate.

Base Flood means a flood having a one percent (1%) chance of being equaled or exceeded in any given year. The base flood shall mean the peak discharge of a 100-year flood of 50 cubic feet per second (cfs) or greater. Said flood shall be determined from an analysis of floods on a particular watercourse, and other watercourses in the same general region, in accordance with the criteria established by the Arizona Department of Water Resources and the Town of Oro Valley, which criteria are hereby, incorporated by reference and made a part of this ordinance.

Basement means any area of a structure with a subgrade floor, i.e., below the adjacent ground level.

Community means any state or area or political subdivision thereof, or any Indian tribe, authorized tribal organization, or authorized native organization, which has authority to adopt and enforce Floodplain Management Regulations for the areas within its jurisdiction.

Community Rating System (CRS) means a program created by FEMA that provides premium reductions on flood insurance to individual policyholders in communities that have adopted programs, standards, and practices that exceed the minimum federal standards.

Critical Facility means a facility such as a hospital, nursing home, police and fire stations, and other public safety facilities that would be severely impacted by flooding interrupting critical services or leading to significant sheltering needs for the sick or elderly.

Cumulative Substantial Damage means the total of all repairs to a repetitive loss structure, which shall not cumulatively increase the market value of the structure by more than 49% during the life of the structure. This term does not, however, include either:

a. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official, and which are the minimum necessary to assure safe living conditions; or

b. Any repair of flood damage to a "historic structure", provided the repair will not preclude the structure's continued designation as a "historic structure."

Detention System means a type of flood control system which delays the downstream progress of flood- waters in a controlled manner, generally through the combined use of a temporary storage area and a metered outlet device, which causes a lengthening of the duration of the flow and thereby reduces downstream flood peaks.

Development means any man-made change to improved or unimproved real estate, including but not limited to structures, mining, dredging, filling, grading, paving, excavation or drilling operations, and storage of materials and equipment located within the regulatory floodplain.

Dwelling means a habitable structure.

Encroachment means the advance or infringement of uses, landscape vegetation, fill, excavation, permanent structures, or development into a floodplain that may impede or alter the flow capacity of a floodplain. An equal degree of encroachment is a standard applied to the evaluation of the effects of the encroachment on increases in flood heights. It assumes that an encroachment, if permitted, may confer on all property owners on both sides of the watercourse an equal right to encroach to the same degree within that reach. Since the factors affecting hydraulic efficiency are usually not uniform within a reach, this standard will usually not result in equal measured distances between regulatory floodway limit lines and the regulatory floodplain boundaries of the watercourse.

Erosion means the process of the gradual wearing away of landmasses resulting from wind, water, or ice.

Erosion Hazard Area means lands adjoining a watercourse that is regulated by this ordinance which are deemed by the Town Engineer to be subject to flood-related erosion losses (Ref. The Adopted Drainage Criteria Manual, Town of Oro Valley).

Erosion Setback means the minimum horizontal distance between a structure or permanent feature and the channel bank necessary to protect the structure/feature from flood related erosion damage. For method to be used for determination of the erosion setback, see the Adopted Drainage Criteria Manual, Town of Oro Valley.

Existing Manufactured Home Park or Subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the

manufactured homes are affixed (including, at a minimum, the installation of utilities, construction of streets, and either final site grading or the pouring of concrete slabs) was completed before the effective date of the floodplain management regulations adopted by the community.

Expansion to an Existing Manufactured Home Park or Subdivision means preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Federal Emergency Management Agency (FEMA) means an agency of the federal government responsible for programs of disaster response and recovery, disaster preparedness, hazard mitigation, flood insurance, and other programs of technical and financial assistance.

Federal Insurance Administration (FIA) means a directorate of FEMA responsible for the National Flood Insurance Program

Flood or Flooding means a general and temporary condition of partial or complete inundation of normally dry land areas caused by the unusual and rapid accumulation or runoff of surface waters from any source.

Flood Insurance Program (FIP) means the federal program established to provide flood insurance and to regulate development in flood hazard zones. Through the FIP, the federal government defines flood hazards and flood hazard zones, and publishes the information on Flood Insurance Rate Maps (FIRMs).

Flood Hazard Boundary Map (FHBM) means any official maps issued by the Town Engineer for the purpose of identifying floodplains/flood-prone areas; also, floodplains/flood-prone areas identified on recorded subdivision plats.

Flood Insurance Rate Map (FIRM) means the official map on which the Federal Emergency Management Agency or Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) means the official report provided by Federal Emergency Management Agency of the Federal Insurance Administration that includes flood profiles, the Flood Insurance Rate Map, and the water surface elevation of the base flood.

Floodplain or Flood-prone Area means any land area susceptible to being inundated by water from any source (see flooding).

Floodplain Administrator is the Town Engineer, or his/her designee, whose duty it is to oversee administration and enforcement of the floodplain management regulations contained in this document.

Floodplain Board means the Town Council of Oro Valley, at such times as they are engaged in the enforcement of this ordinance.

Floodplain Management means the operation of an integrated natural resource management program encompassing corrective and preventive measures for reducing flood and erosion damage. Floodplain management includes but is not limited to emergency preparedness planning, flood control works and Floodplain Management Regulations.

Floodplain Management Regulations means this ordinance and other zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as grading and erosion control), and other applications of legal and regulatory authority that control use of, and development in, flood-prone areas. This term describes federal, state, or local regulations, and any combination thereof, which provide standards for preventing and reducing flood loss and damage.

Floodplain Use Permit means an official document that authorizes special activity within the regulatory floodplains or erosion hazard areas of Oro Valley.

Flood Protection System means those physical structural works for which funds have been authorized, appropriated, and expended; and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to designation as a regulatory floodplain as well as the extent and depths of associated flooding. Such a system typically includes dams, reservoirs, levees or dikes. These specialized flood-modifying works are those constructed in conformance with sound engineering standards.

Flood-Proofed means a watertight structure with walls substantially impermeable to the passage of water, and with structural components having the capability of resisting hydrostatic

and hydrodynamic loads and the effects of buoyancy.

Flood-Proofing means any combination of structural and non-structural additions, changes, or adjustments to structures that reduces or eliminates flood damage to real estate or improved real property, water and sanitary facilities, structures, and their contents.

Flood-related Erosion means the collapse, subsidence, or lateral migration of land along a wash as a result of undermining caused by flowing water.

Floodway means the channel of a watercourse and the adjacent land areas that must be reserved in order to provide for the passage of floodwaters or flood flows (see regulatory floodway).

Floodway Fringe is that area of the floodplain lying on either side of a regulatory floodway where encroachment may be permitted.

Governing Body is the local governing unit (i.e., county or municipality) empowered to adopt and implement regulations providing for the public health, safety, and general welfare of its citizenry.

Hardship means that the physical characteristics of the property in question are so unusual, exceptional, and peculiar that a variance regarding its use may be requested and granted. Mere economic or financial hardship alone is not exceptional. Inconvenience, aesthetic considerations, physical handicaps, personal preferences, or the disapproval of one's neighbors likewise cannot, as a rule, be construed to qualify as an exceptional hardship. All of these problems can be resolved through other means without granting a variance, even if the alternative is more expensive, requires the property owner to build elsewhere, or means that the parcel must be put to a different use than originally intended.

Highest Adjacent Grade means the highest natural elevation of the ground surface immediately adjacent to a structure prior to construction of the proposed walls of a structure.

Historic Structure means any structure that is:

A. Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

B. Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;

C. Individually listed on State of Arizona as inventory of historic places, as approved by the Secretary of the Interior; or

D. Individually listed on the Town of Oro Valley's inventory of historic places and that have been certified by an approved State of Arizona program, as determined by the Secretary of the Interior.

Levee means a human-made structure, usually an earthen embankment designed and constructed in accordance with sound engineering practices, for the purpose of containing, controlling, or diverting the flow of water so as to provide protection from temporary flooding.

Lowest Floor means the lowest floor of the lowest enclosed area including the basement (see basement definition) or crawl space under a manufactured home if it is not vented. An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access, or storage in an area other than a basement area is not considered to be the lowest floor of a structure; provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance.

Manufactured Home means a structure, transportable in one or more sections, which in the traveling mode is eight (8) feet or more wide or forty (40) feet or more in length, or when erected on site, is 320 or more square feet, and which is built on a permanent foundation and contains plumbing, heating, air cooling, and electrical systems.

Manufactured Home Park or Subdivision means any lot, tract, or parcel of land used or offered for use, in whole or in part, with or without charge, for parking of manufactured homes or trailer coaches used for sleeping or household purposes.

Market Value means the determination of the estimated cost to replace the structure in new condition and adjusting that cost figure by the amount of depreciation that has accrued since the structure was constructed. The cost of replacement of the structure shall be based on a square foot cost factor determined by reference to a building cost estimating guide recognized by the building construction industry. The amount of depreciation shall be determined by taking

into account the age and physical deterioration of the structure and functional obsolescence as approved by the floodplain administrator, but shall not include economic or other forms of external obsolescence. Use of replacement costs or accrued depreciation factors different from those contained in recognized building cost estimating guides may be considered only if such factors are included in a report prepared by an independent professional appraiser and supported by a written explanation of the differences.

Mean Sea Level means, for purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD) of 1929, North American Vertical Datum of 1988 (NAVD '88), or other datum to which base flood elevations shown on a community's Flood Insurance Rate Map are referenced.

National Flood Insurance Program (NFIP) means a program administered by FEMA that makes federally backed flood insurance available for purchase by individuals that live in NFIP participating communities.

New Construction means structures and any subsequent improvements to such structures for which the start of construction commenced on or after the effective date of adoption of:

A. An initial FIRM or after December 31, 1974, whichever is later, within federally regulated flood hazard zones.

B. This chapter for floodplain and erosion hazard management.

Obstruction includes, but is not limited to, any dam, wall, embankment, levee, dike, pile, abutment, protection, excavation, channelization, bridge, conduit, culvert, structure, wire, fence, rock, gravel, refuse, fill, structure, vegetation, or other material in, along, across, or projecting into any watercourse which may alter, impede, retard, or change the direction and/or velocity of the flow of water, or which due to its location influences its propensity to snare or collect debris carried by the flow of water, thereby reducing its likelihood of being carried downstream as well as reducing the channel's ability to convey flow.

One Hundred Year Flood means the flood having a one percent chance of being equaled or exceeded in any given year (see base flood).

Person means an individual or his agent, firm, partnership, association or corporation, or agent of the aforementioned groups, or the State of Arizona or its agencies or political subdivisions.

Program means the National Flood Insurance Program authorized by 42 U.S.C. 4001-4128, or as authorized by subsequent Federal statutes.

Reach is a hydraulic engineering term to describe longitudinal segments of a stream or watercourse. A reach will generally include the segment of the flood hazard area where flood heights are primarily controlled by man-made or natural obstructions or constrictions. In an urban area, an example of a reach would be the segment of a stream or watercourse between two consecutive bridge crossings.

Recreational Vehicle means a vehicle that is:

A. Built on a single chassis;

B. 400 square feet or less in area, when measured at the largest horizontal projection;

C. Designed to be self-propelled or permanently towable by a light duty truck; and

D. Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Regulatory Flood Elevation means an elevation that is one foot above the calculated water surface elevation of the base flood.

Regulatory Floodplain or Flood-Prone Area means that portion of the geologic floodplain associated with a water-course, including its channel or any other floodplain or flood-prone area that would be inundated by the base flood. It also means areas which are subject to sheet flooding, special flood hazard areas, and those areas mapped as floodplains/flood-prone on recorded subdivision plats or other flood hazard boundary maps.

Regulatory Floodway means the channel of a watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than 1 (one) foot, where the owner of the land doing the development owns both sides of the watercourse, and not more than 0.1 foot where only one side is owned. In no case should the development increase the water surface elevation more than 0.1 foot on the property owned by others that is located upstream and downstream of the development. The aforementioned water surface elevation increases apply to all watercourse

channels in Oro Valley except the Canada del Oro wash where the elevation of the existing levee system and bank protection will allow for no water surface elevation increases due to encroachment. Additionally, when main channel flood-flow velocities are greater than 4.0 feet per second (fps), flood-flow velocities shall not increase by more than 1.0 fps or 10 percent, whichever is less, in the regulatory floodway. Any velocity increase greater than the aforementioned criteria must be reviewed, and approved by the Town Engineer.

Remedy a violation means to bring the structure or other development into compliance with State or local floodplain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of this ordinance, otherwise deterring future similar violations, or reducing Federal financial exposure with regard to the structure or other development.

Repetitive Loss Structure means a structure, covered by a contract for flood insurance issued pursuant to the National Flood Insurance Act, that has incurred flood-related damage on two occasions during any 10-year period ending on the date of the event for which a second claim is made, and for which the cost of repairing the flood damage, on average, equaled or exceeded 25% of the market value of the structure at the time of each such flood event. In addition to the current claim, the NFIP must have paid the previous qualifying claim.

Retention System means a type of flood control system that stops the downstream progress of flood water by employing methods of total containment which generally involve creation of storage areas that incorporate infiltration devices, such as dry wells, to dispose of stored waters, principally by percolation over some specified period of time, thereby eliminating basin contributions to downstream flood peaks or flood volumes.

Riverine means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

Sheet Flow Area (see Area of Shallow Flooding)

Special Flood Hazard Area (SFHA) means an area designated by FEMA as having a special flood or flood related erosion hazard, and is the land subject to a one-percent or greater chance of flooding in any given year. A SFHA may be designated on a FHBM or FIRM as a Zone A or shaded Zone X for the base flood, as well as for areas that the Town Engineer, using the best available data, has determined may be subject to a flood hazard during the base flood.

Start of Construction includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days of the permit date; and provided the first Town of Oro Valley inspection is completed by the Town, at the request of the permittee, within 180 days of permit issuance. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction also includes filling, the installation of streets and/or walkways, the installation on the property of accessory structures, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor or other structural part of a structure, whether or not that alteration affects the external dimensions of the structure.

Structure means any building or containment unit that is constructed or erected, the use of which requires location on the ground or attachment to a foundation having a location on the ground.

Substantial Damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred. Substantial damage also means flood-related damage sustained by a structure on two separate occasions during a rolling 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred.

Substantial Improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value

of the structure before the start of construction of the improvement. This term includes structures that have incurred repetitive loss or substantial damage, regardless of the actual repair work performed. The term does not, however, include either:

A. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official, and which are the minimum necessary to assure safe living conditions, or

B. Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a historic structure.

Variance means a modification of the literal provisions of this ordinance that is granted by the Floodplain Administrator or the Floodplain Board (for FEMA floodplains) upon a finding that strict enforcement of the provisions would cause undue hardship owing to circumstances unique to the individual property for which the variance is granted, and not caused by the applicant for said variance.

Violation means the failure of a structure or other development to be fully compliant with the Town of Oro Valley Floodplain Management Regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required by this ordinance, is presumed to be in violation until such time as such documentation is provided. Violation also means unauthorized construction, grading, encroachment, diversion, or lack of maintenance of private drainage structures.

Water Surface Elevation means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929 or the North American Vertical Datum (NAVD) of 1988 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of riverine areas.

Watercourse means a lake, river, creek, stream, wash, arroyo, channel, or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur, including regulatory floodplains as designated by FEMA or the Town of Oro Valley.

((O)05-35, Enacted, 10/05/2005)

Article 17-3
GENERAL PROVISIONS

Sections:

17-3-1 Lands to Which This Ordinance Applies

This ordinance shall apply to all regulatory floodplain areas within the corporate limits of the Town of Oro Valley, but only to such areas.

((O)05-35, Enacted, 10/05/2005)

17-3-2 Basis for Establishing the Regulatory Floodplain Areas

The regulatory floodplain areas identified by the Federal Insurance Administration (FIA) of the Federal Emergency Management Agency (FEMA) in a scientific and engineering report entitled The Flood Insurance Study (FIS) for Pima County, Arizona and incorporated areas,

revised February 8, 1999, with accompanying Flood Insurance Rate Maps (FIRMs) dated February 8, 1999 and all subsequent amendments and/or revisions, are hereby adopted by reference and declared to be a part of this ordinance. This Flood Insurance Study (FIS) and attendant mapping may be supplemented by studies for other areas that allow implementation of this ordinance. The Floodplain Board, within the incorporated limits of the Town of Oro Valley, shall require developers of land to delineate, within areas where development is ongoing or imminent, floodplains consistent with the criteria developed by the FEMA, the Arizona Director of Water Resources, and the Town Engineer, pursuant to the Town's adopted Drainage Criteria Manual. The Flood Insurance Study, FIRMs, and FHBMs are on file at the Oro Valley's Department of Public Works, 11000 N. La Canada Drive, Oro Valley, Arizona.

Additionally, areas determined by the Town Engineer and /or shown on FHBMs, including floodplains/flood-prone areas identified on previously recorded subdivision plats (and those recorded hereafter), are also hereby adopted, by reference, and declared a part of this ordinance.

A. Regulatory floodplains shall be subject to the following regulations, except as hereinafter provided:

1. No person or persons shall construct any structure which will divert, retard, or obstruct the flow of water in any stream, watercourse, or regulatory floodplain area without having secured all necessary permits from any governmental agency from which approval is required by Federal or State or Local law, and said permits or copies thereof shall be provided to the Floodplain Administrator for review.

2. No person shall construct any structure that will divert, retard, or obstruct the flow of water in any stream, watercourse, or regulatory floodplain area without securing written authorization in the form of a Floodplain Use Permit from the Town of Oro Valley, except as exempted in Section 17-3-6 of this ordinance.

3. The FIS and areas shown on FHBMs together with floodplains associated with washes and/or sheet flow areas having 100-year peak discharges of 50 cfs or more, are the minimum areas of applicability of this ordinance, and may be supplemented by studies for other areas that allow implementation of this ordinance. Applicants for development in the Town of Oro Valley shall delineate floodplains consistent with criteria developed by FEMA, the Town Engineer, and/or pursuant to the Town's adopted Drainage Criteria Manual.

4. All property in the regulatory floodplains, except that covered by statutory exemptions, shall be governed according to the provisions herein.

5. Any use of land otherwise authorized by law shall be permitted, provided such use meets the minimum standards of the regulations hereinafter set forth.

B. Elevation and Boundary Refinements:

1. The determination of elevations (water surface, lowest finished floor, and adjacent land) and regulatory floodway and regulatory floodplain boundaries is an engineering function with calculations and decisions made in accordance with the concepts and policies set forth in this ordinance. The best technical data available shall be used for such calculations and decisions. Initial determinations shall be based on floodplain information reports of the Pima County Flood Control District, Corps of Engineers, U.S. Bureau of Reclamation, U.S. Geological Survey, and/or other general data that are pertinent for the conditions of the streams or the watercourses at the time the data are obtained.

2. Additional and more detailed technical analysis will, from time to time, become available through private or governmental studies and activities. These data will permit refinements in the elevations and boundaries of regulatory floodway and regulatory floodplains in the respective reaches of the streams or watercourses.

3. Whenever such additional data become available and it seems desirable to make refinements i.e. Letter of Map Amendments (LOMA's) or Letter of Map Revisions (LOMR's), such refinements or revisions may be made at the request of the property owners or developers or by the Town Engineer. The necessary engineering calculations shall be made for the property owner or developer by an Arizona Registered Professional Civil Engineer (at the owner's/ developer's expense) in conformance with requirements of this chapter, the FEMA, and the Arizona Department of Water Resources. These findings will need approval of the Town Engineer. Following the Town's approval of these refinements to regulatory floodplain areas identified on FIRMs and FHBMs, the property owner shall have calculations and forms forwarded to FEMA for review and approval.

4. The Town Engineer or his/her duly designated representative shall have the

authority and responsibility to revise and refine elevations and boundaries of regulatory floodways and regulatory floodplains whenever such revisions and refinements are for the purpose and in accordance with the conditions set forth in Sections 17-5-8B.3, 17-5-8B.4, and 17-5-8B.5 of this ordinance.

a. The Flood Insurance Rate Map for Pima County and Incorporated Areas shall be revised to show the refined area boundaries and/or elevations.

b. The Town Engineer shall notify the owner of each property for which area boundaries and/or elevations have been revised or refined, as well as those owners of adjoining property immediately upstream and downstream, by first class mail following a duly noticed public hearing on the property involved.

c. An appeal to the Floodplain Board may be taken by any person aggrieved, in accordance with Article 17-6 of this ordinance.

((O)05-35, Enacted, 10/05/2005)

17-3-3 Compliance

All development of land, construction of residential, commercial, or industrial structures, or future development within delineated floodplain areas is subject to the terms of this ordinance.

((O)05-35, Enacted, 10/05/2005)

17-3-4 Abrogation and Greater Restrictions

The provisions of this ordinance are not intended to interfere with, abrogate, or annul any ordinance, rule, regulations, or permit previously adopted or issued, and not be in conflict with any provision of this ordinance or any regulation that shall be adopted or issued pursuant to law relating to the use of structure or ordinance not in conflict with this ordinance; nor is it intended by this ordinance to interfere with or abrogate or annul any easement, covenant, or other agreement between parties, except when this ordinance imposes a greater restriction, this ordinance shall control.

((O)05-35, Enacted, 10/05/2005)

17-3-5 Interpretation

In the interpretation and application of this ordinance, all provisions shall be:

A. Considered as minimum requirements;

B. Liberally constructed in favor of the governing body; and,

C. Deemed neither to limit nor repeal any other powers granted under state statutes.

((O)05-35, Enacted, 10/05/2005)

17-3-6 Statutory Exemptions

A. In accordance with ARS 48-3609.H, unless expressly provided this and any regulation adopted pursuant to this article do not affect:

1. Existing legal uses of property or the right to continuation of such legal use. However, if a nonconforming use of land or a structure is discontinued for twelve (12) months or destroyed to the extent of fifty (50) percent of its value, as determined by three competent appraisers, any further use shall comply with this article and regulations of the Town of Oro Valley.

2. Reasonable repair or alteration of property for the purposes for which the property was legally used on August 3, 1984, or any regulations affecting such property takes effect, except that any alteration, addition, or repair to a nonconforming structure which would result in increasing its flood damage potential by fifty (50) percent or more shall be either flood-proofed or elevated to or above the regulatory flood elevation.

3. Reasonable repair of structures constructed with the written authorization required by ARS §48-3613.

4. Facilities constructed or installed pursuant to a certificate of environmental compatibility issued pursuant to ARS Title 40, Chapter 2, Article 6.2.

B. In accordance with ARS §48-3613, a floodplain use permit giving written authorization shall not be required, nor shall the Floodplain Board or Town Engineer prohibit:

1. The construction of bridges, culverts, dikes, and other structures necessary for the construction of public highways, roads, and streets intersecting or crossing a watercourse.

2. The construction of storage dams for watering livestock or wildlife, structures on

banks of a watercourse to prevent erosion of, or damage to, adjoining land, if the structure will not divert, retard or obstruct the natural channel of the watercourse, or dams for the conservation of floodwaters as permitted by ARS title 45, chapter 6.

3. The construction of tailing dams and waste disposal areas for use in connection with mining and metallurgical operations. This paragraph does not exempt those sand and gravel operations that will divert, retard or obstruct the flow of waters in any watercourse from complying with, and acquiring authorization from, the Town Engineer or the Floodplain Board pursuant to regulations adopted by the Floodplain Board under this article.

4. Other construction, if it is determined by the Town Engineer that a floodplain use permit is unnecessary.

5. Any flood control district, county, city, town, or other political subdivision from exercising powers granted to it under this article.

6. The construction, by a public agency or political subdivision, of streams, waterways, lakes, and other auxiliary facilities in conjunction with development of public parks and recreation facilities.

7. The construction and erection of poles, towers, foundations, support structures, guy wires, and other facilities related to power transmission as constructed by any utility, whether a public service corporation or a political subdivision.

8. The development and/or structure permitted in special permits granted by the State agency having the primary land management administrative duty over the lands if development or construction is to be on lands owned or held in trust by the State.

9. Future development in an approved subdivision provided seventy-five (75) percent of such regulatory floodplain area within the platted and approved subdivision to be developed and utilized for dwelling units or commercial or industrial structures has been so developed and utilized as of August 8, 1973.

C. Before any construction authorized by Subsection B of this section may begin, the responsible person must submit grading plans and a grading permit application. The applicant must obtain necessary plan and permit approvals, as well as meet requirements pursuant to the Oro Valley Zoning Code (Revised), Town of Oro Valley Drainage Criteria Manual, and any other applicable Town standards.

D. In addition to other penalties or remedies otherwise provided by law, the state of Arizona, a political subdivision thereof, or a person who may be damaged or has been damaged as a result of the unauthorized diversion, retardation, or obstruction of a watercourse has the right to go through an Administrator/Board to commence, maintain, and prosecute any appropriate action or pursue any remedy to enjoin, abate, or otherwise prevent any person from violating or continuing to violate this section or regulations adopted pursuant to this article. If a person is found to be in violation of this section, the Administrator/Board shall require the violator either to comply with this section, if authorized by the Floodplain Board for FEMA regulated floodplains (the Town Engineer for non-FEMA regulated floodplains), or to remove the obstruction and restore the watercourse to its original state. The court may also award such monetary damages as are appropriate to the injured parties resulting from the violation, including reasonable costs and attorney fees.

((O)05-35, Enacted, 10/05/2005)

17-3-7 Floodplain Violations

A. DECLARATION OF PUBLIC NUISANCE. Every new structure, fill, excavation, or development located or maintained within any regulatory floodplain area after August 8, 1973, in violation of this ordinance, and without written authorization from the Floodplain Board for FEMA regulated floodplains (the Town Engineer for non-FEMA regulated floodplains), is a public nuisance per se, and may be abated, prevented or restrained by action of the Floodplain Board.

((O)05-35, Enacted, 10/05/2005)

17-3-8 Abatement of Violations

Upon discovery of a violation to this ordinance, the Floodplain Administrator shall either:

A. Take any necessary action to effect the abatement of such violation; or

B. Order the owner of the property upon which the violation exists to provide whatever additional information may be required for determination by the floodplain administrator. Such

information must be provided to the Floodplain Administrator within 30 days of such order. Within 30 days, the Floodplain Administrator shall either order the abatement of said violation or shall grant a variance in accordance with the provisions of Article 17-6-4 herein; or

C. For FEMA regulated floodplains, submit to the Administrator of the Federal Insurance Administration a declaration for denial of insurance, stating that the property is in violation of a cited state or local law, regulation or ordinance, pursuant to Section 1316 of the National Flood Insurance Act of 1968, and as amended.

((O)05-35, Enacted, 10/05/2005)

17-3-9 Unlawful Acts

A. It is unlawful for any person to divert, retard or obstruct the flow of waters in any watercourse whenever it creates a hazard to life or property without securing the written authorization of the Floodplain Administrator or the Floodplain Board for FEMA regulated floodplains. Where the watercourse is a delineated floodplain, it is unlawful to excavate or build any structure affecting the flow of waters without securing written authorization of the Floodplain Administrator or the Floodplain Board for FEMA regulated floodplains.

B. It is unlawful for any person to neglect maintenance responsibilities on private drainage improvements.

C. Any person violating the provisions of this section shall be subject to penalties pursuant to Article 1-8, Penalties, Oro Valley Town Code.

((O)05-35, Enacted, 10/05/2005)

17-3-10 Remedies

All remedies provided for herein shall be cumulative and not exclusive. The conviction and punishment of any person hereunder shall not relieve such person from the responsibility to correct prohibited conditions or to remove prohibited structures, obstructions, or improvements; nor prevent the enforcement, correction, or removal thereof. In addition to the other penalties or remedies provided in this Article, the state of Arizona, any political subdivision thereof, or any person who may be damaged as a result of the diversion, retardation, or obstruction of a watercourse shall have the right to commence, maintain, and prosecute any appropriate action or pursue any remedy to enjoin, abate, or otherwise prevent any person from violating or continuing to violate any provision of this ordinance.

((O)05-35, Enacted, 10/05/2005)

17-3-11 Severability

This ordinance, and its various parts thereof, is hereby declared to be severable. Should any section of this ordinance be declared by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the ordinance as a whole, or any portion thereof, other than the section so declared to be unconstitutional or invalid.

((O)05-35, Enacted, 10/05/2005)

17-3-12 Warning and Disclaimer of Liability

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes, and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the regulatory floodplain areas or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of the Town of Oro Valley, any officer or employee thereof, the state of Arizona, the Federal Insurance Administration, or the Federal Emergency Management Agency, for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made hereunder.

((O)05-35, Enacted, 10/05/2005)

Article 17-4
ADMINISTRATION

Sections:

17-4-1 Establishment of Floodplain Use Permits

A. RESPONSIBILITY FOR PERMITS: It shall be the duty of the Town Engineer and all departments, officials, and public employees vested with the duty or authority to issue permits or licenses, to enforce the provisions of this ordinance; and no such license or permit shall be issued for uses or building where the same would be in conflict with the provisions of this ordinance. Any such license or permit, if issued in conflict with the provisions of this ordinance, shall be null and void.

B. FLOODPLAIN USE PERMITS: It shall be unlawful to erect, construct, reconstruct, alter, or change the use of any structure within any regulatory floodplain area covered by this ordinance without first applying for and obtaining a Floodplain Use Permit from the Town Engineer; but no such Floodplain Use Permit shall be required for any repairs or improvements for which the value of the materials and labor thereon does not exceed $7500.00. For the purpose of determining the value of any such repairs, alterations, or improvements, the normal retail value of materials and reasonable value of the labor performed shall be used. Even though no Floodplain Use Permit is required, all other provisions of this ordinance shall be observed in the performance of said repairs or improvements, and this section shall be interpreted to apply only to repairs or improvements that, in fact, constitute complete units, and shall not apply to any effort to repair or improve property units, piecemeal, and by subterfuge for the purpose of avoiding applying for a permit when the cost of said work is, in fact, in excess of $7500.00.

C. APPLICATION FOR FLOODPLAIN USE PERMIT: Application for a Floodplain Use Permit shall be made on forms furnished by the Town Engineer, and must include, without limitation, plans in duplicate drawn to scale showing the nature, location, dimensions, and elevation of the areas in question; existing or proposed structures including walls, bank protection, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required:

1. Proposed elevation, in relation to mean sea level, of the lowest floor (including basement) of all structures. In a designated Zone AO, elevation of existing highest adjacent natural grade and proposed elevation of lowest floor of all structures must be obtained;
2. Proposed elevation, in relation to mean sea level, to which any structure will be flood-proofed;
3. Certification by an Arizona Registered Professional Civil Engineer or an Arizona Registered Professional Architect that the flood-proofing methods for any nonresidential structure meet the flood-proofing criteria in Section 17-5-1.C; and
4. Description of the extent to which any watercourse will be altered or relocated as a result of proposed development. Each such application shall be accompanied by an application fee, as set forth by the Town, payable to the Town of Oro Valley.

((O)05-35, Enacted, 10/05/2005)

17-4-2 Enforcement and Inspection

A. ENFORCEMENT: It shall be the duty of the Town Engineer, through his/her duly appointed Floodplain Administrator and officials of the Town otherwise charged with the enforcement of the law, to enforce this ordinance and all of the provisions of the same.

B. INSPECTIONS: Inspections shall be made by the Town Engineer or by a duly appointed Floodplain Administrator.

C. COOPERATION: The Town Floodplain Administrator may request, and shall receive so far as may be necessary in the discharge of his/her duties, the assistance and cooperation of all departments, agencies, officials, and public employees vested with the duty or authority to issue permits, licenses, or to enforce the regulations of this ordinance.

D. TOWN OF ORO VALLEY ADMINISTRATION: Hydrologic, hydraulic, and related floodplain regulations, as well as engineering matters pertaining to the administration and

direction of this ordinance, shall be referred to the Town of Oro Valley Town Engineer or his/her designated representative, who shall be responsible for such reviews, advice, and recommendations.

E. COOPERATION AGREEMENTS AND CONSULTANTS: The Floodplain Administrator, through the applicable procurement and/or intergovernmental agreement procedures, may retain consultants and experts; and may enter into cooperative agreements for the delineation of floodplains and floodways as well as for such other assistance and guidance considered appropriate and necessary to obtain maximum reasonable protection and benefits under this ordinance.

((O)05-35, Enacted, 10/05/2005)

17-4-3 Duties of Floodplain Administrator and Use Permit Procedures

A. The Floodplain Administrator shall issue Floodplain Use Permits required by this Section.

B. The following procedure shall be used by the Floodplain Administrator in considering issuance of Floodplain Use Permits.

1. Upon receiving an application for a Floodplain Use Permit involving the use of fill, construction of structures, or the storage of materials, and prior to rendering a decision thereon the Floodplain Administrator may:

a. Require the applicant to submit, where applicable, plans in triplicate drawn to scale showing the nature, location, dimensions, and elevations of the lot; existing or proposed structures, fill, storage of materials, flood-proofing measures; and the relationship of the above to the location of the channel, regulatory floodway, the regulatory floodplain with base flood elevations, the proposed project in relation to flood heights and velocities, and the plans for flood protection. The applicant shall provide a new delineation of all regulatory floodplains affected by the project. The new delineation and reports shall be prepared in conformance with FEMA requirements and this ordinance. The delineation shall show pre- and post-project floodplain limits and water surface elevations upstream, adjacent, and downstream of the project.

b. Require, where circumstances necessitate more detailed information, the applicant to furnish as much of the following additional information as is deemed necessary by the Floodplain Administrator for the evaluation of the effects of the proposed use upon flood flows and the consideration of other factors necessary to render a decision on suitability of the proposed use:

(i) A typical valley cross-section showing the floodway, floodway fringe area, and the floodplain of the watercourse; elevation of land areas adjoining each side of the channel; cross-sectional areas to be occupied by the proposed development; and high water information.

(ii) A plan (surface view) showing elevations or contours of the ground; pertinent structure, fill or storage elevations; size, location, and spatial arrangement of all proposed and existing structures on the site; location and elevations of streets, water supply, sanitary facilities; photographs showing existing land uses and vegetation upstream and downstream, and soil types, as well as other pertinent information;

(iii) A profile showing the slope of the bottom of the channel or flow line of the watercourse;

(iv) Specifications for building construction and materials, flood-proofing, filling, dredging, grading, channel improvement, storage of materials, water supply, and sanitary facilities;

c. Ensure that the proposed development does not adversely affect the carrying capacity of channels at locations where base flood elevations have been determined but a floodway has not been designated. For purposes of this ordinance, adversely affects means that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will increase the water surface elevation of the base flood more than one (1) foot where the owner of the land doing the development owns both sides of the floodway and more than 0.1 foot where only one side is owned. In no case shall the development increase the water surface elevation more than 0.1 foot on the properties owned by others that are located upstream and downstream. The aforementioned water surface elevation increases apply to all watercourse channels in Oro Valley except the Canada del Oro Wash where the elevation of the existing levee system and bank protection will allow for no

water surface elevation increases due to encroachment. Additionally, when main channel flood-flow velocities are greater than 4.0 feet per second (fps), flood-flow velocities shall not increase by more than 1.0 fps or ten (10) percent, whichever is less, in the regulatory floodway. Any velocity increase greater than the aforementioned criteria must be reviewed and approved by the Town Engineer.

d. For FEMA regulated floodplains, require the applicant to submit appropriate (e.g. CLOMR, CLOMR-F, etc.) applications, forms, and information to FEMA for review and approval. A Floodplain Use Permit shall be issued by the Town of Oro Valley upon acknowledgement from FEMA of the acceptance of the CLOMR.

e. Ensure other related State of Arizona and federal permits have been issued.

2. No permit shall be issued for any development that is not in conformance with this ordinance, FEMA regulations, or some other provision of law relating to such development. A Floodplain Use Permit may be denied if the proposed development constitutes a danger or hazard to life or property. In making such a determination, the Floodplain Administrator may consider the following factors:

a. The danger to life and property due to increased flood heights or velocities caused by encroachments;

b. The danger that materials may be swept on to other lands or downstream to the injury of others;

c. The proposed water supply and sanitation systems, and the ability of these systems to prevent disease, contamination, and unsanitary conditions;

d. The susceptibility of the proposed facility and its contents to flood damage, and the affect of such damage on the individual owner;

e. The importance of the services provided by the proposed facility to the community;

f. The availability of alternative locations for the proposed use that are not subject to flooding;

g. The compatibility of the proposed use with existing development and development anticipated in the foreseeable future;

h. The relationship of the proposed use to the comprehensive plan and Floodplain Management program for the area encompassing the proposed use;

i. The safety of access to the property in times of flood for ordinary and emergency vehicles;

j. The expected heights, velocity, duration, rate of rise, development potential, and sediment transport of the floodwaters expected at the site;

k. Such other factors as are relevant to the purposes of this ordinance.

3. Upon consideration of the factors listed above and the purposes of this ordinance, the Floodplain Administrator may attach such conditions to the granting of a Floodplain Use Permit as he/she deems necessary to further the purposes of this ordinance, including but not limited to:

a. Modification of waste disposal and water supply facilities;

b. Limitations on periods of use and of operation;

c. Imposition of operational controls, sureties related to temporary uses, and deed restrictions;

d. Requirements for construction of channel modifications, dikes, levees, and other protective measures;

e. Flood-proofing measures such as the following shall be designed consistent with the regulatory flood elevation for the particular area: Flood velocities, duration, rate of rise, hydrostatic and hydrodynamic forces, and other factors associated with the base flood. The Floodplain Administrator may require that the applicant submit a plan document, certified by an Arizona Registered Professional Civil Engineer, that the flood-proofing measures are consistent with the regulatory flood elevation and associated flood factors for the particular area. The following flood-proofing measures may be required, without limitation, because of specific enumeration:

(i) Anchorage to resist floatation and lateral movement;

(ii) Installation of watertight doors, bulkheads, and shutters;

(iii) Reinforcement of walls to resist water pressures;

(iv) Use of paints, membranes, or mortars to reduce seepage of water through the walls;

(v) Addition of mass or weight to structures to resist floatation;

(vi) Installation of pumps to lower water levels in structures;

(vii) Construction of water supply and waste treatment systems so as to prevent the entrance of floodwaters;

(viii) Pumping facilities to relieve sub-surface external foundation wall and basement floor pressures;

(ix) Construction to resist rupture or collapse caused by water pressure or floating debris;

(x) Cut-off valves on sewer lines, or the elimination of gravity flow basement drains; or

(xi) Elevation of structures, and uses to the regulatory flood elevation.

C. The Floodplain Administrator shall be responsible for the following duties:

1. Obtain and maintain for public inspection and make available the following:

a. The certified regulatory flood elevation required in Section 17-5-1.C.1;(ARS.§ 48-3609);

b. The Zone AO certification required in Section 17-5-1.C.2;

c. The floodproofing certification required in Section 17-5-1.C.3;

d. The certified opening elevation required in Section 17-5-1.C.4.b; and

e. Permit records for repair of flood-related damage to structures on a cumulative basis over the life of the structure.

2. Whenever a watercourse is to be altered or relocated:

a. Notify adjacent communities and ADWR prior to such alteration or relocation of a watercourse, and submit evidence of such notification to FIA through appropriate notification means; and

b. Require that the flood carrying capacity of the altered or relocated portion of said watercourse be maintained.

3. Within one hundred twenty days after completion of construction of any flood control protective works which changes the rate of flow during the flood or the configuration of the floodplain upstream or downstream from or adjacent to the project, the person or agency responsible for installation of the project shall provide to the governing bodies of all jurisdictions affected by the project a new delineation of all floodplains affected by the project. The new delineation shall be done according to the criteria adopted by the ADWR. (A.R.S. § 48-3609 (I)).

4. Advise the district of Pima County and any adjunct jurisdiction having responsibility for floodplain management in writing and provide a copy of a development plan of all applications for floodplain use permits or variances to develop land in a floodplain or floodway within one mile of the corporate limits of the Town of Oro Valley, AZ. Also, advise the district of Pima County in writing and provide a copy of any development plan of any major development proposed within a floodplain or floodway, which could affect floodplains, floodways or watercourses within the district's area of jurisdiction. Written notice and a copy of the plan of development shall be sent to the district no later than three (3) working days after having been received by Town of Oro Valley. (A.R.S. § 48-3610 (B) (2))

5. Notify FEMA and ADWR of acquisition by means of annexation, incorporation or otherwise, of additional areas of jurisdiction.

6. A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator (FEMA) of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements will be based upon current data.

((O)05-35, Enacted, 10/05/2005)

17-4-4 Designation of the Floodplain Administrator

The Town Engineer or his/her designee is hereby appointed to administer, implement, and enforce this ordinance and guidelines set forth in Article 17.4, Administration, by processing Floodplain Use Permits in accordance with its provisions.

((O)05-35, Enacted, 10/05/2005)

Article 17-5

PROVISIONS FOR FLOOD HAZARD REDUCTION

Sections:

17-5-1 Standards of Construction

In all regulatory floodplain areas, the following standards are required:

A. Anchoring

1. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

2. All manufactured homes shall meet the anchoring standards of Section 17-5-5.

B. Construction Materials and Methods

1. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

2. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

3. All new construction, substantial improvements, and other proposed new development shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment, as well as other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

4. Within Zones AH or AO, adequate drainage paths around structures on slopes are required to guide floodwaters around and away from proposed or existing structures and downstream development.

C. Elevation and Flood-proofing

1. New construction and substantial improvement of any structure shall have the lowest floor, including basement, elevated at or above the regulatory flood elevation. In areas without a detailed study but within regulatory floodplain boundaries, the applicant shall have an Arizona Registered Professional Civil Engineer prepare a detailed study to determine the depth of the regulatory flood. Nonresidential structures may meet the standards in Section 17-5-1.C.3. Upon the completion of the structure, the elevation of the lowest floor including basement, shall be certified by an Arizona Registered Professional Civil Engineer or an Arizona Registered Professional Land Surveyor, and provided to the Floodplain Administrator and the Town Building Official.

2. New construction and substantial improvement of any structure in Zone AO shall have the lowest floor, including basement, higher than the highest adjacent grade at least one foot higher than the depth number on the FIRM, or at least two feet if no depth number is specified. Nonresidential structures may meet the standards in Section 17-5-1.C.3. Upon completion of the structure an Arizona Registered Professional Civil Engineer shall certify to the Floodplain Administrator that the elevation of the structure meets this standard.

3. Nonresidential construction shall either be elevated in conformance with Section 17-5-1.C.1 or 2, or together with attendant utility and sanitary facilities:

a. Be flood-proofed so that below the regulatory flood elevation the structure is watertight with walls substantially impermeable to the passage of water;

b. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

c. Be certified by an Arizona Registered Professional Civil Engineer or an Arizona Registered Professional Architect that the standards of this subsection are satisfied. Such certifications shall be provided to the Floodplain Administrator and the Town Building Official.

4. Require, for all new construction and substantial improvements of non-residential

structures, that fully enclosed areas below the lowest floor that are useable solely for parking of vehicles, building access, or storage in an area other than a basement, and which are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by an Arizona Registered Professional Civil Engineer or an Arizona Registered Professional Architect to meet or exceed the following minimum criteria:

a. A minimum of two openings, on different sides of each enclosed area, shall be provided having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding.

b. The bottom of all openings shall be no higher than one foot above grade.

c. Openings may be equipped with screens, louvers, valves, or other coverings or devices, provided that they permit the automatic entry and exit of floodwaters.

5. Manufactured homes shall meet the above standards and the standards in Section 17-5-5.

((O)05-35, Enacted, 10/05/2005)

17-5-2 Standards for Storage of Materials and Equipment

A. The storage or processing of materials is prohibited if they are, in time of flooding: buoyant, flammable, explosive, or could be noxious, deadly, or injurious to human, animal, or plant life.

B. Storage of other material or equipment may be allowed if they are not subject to major damage by floods, or if they are firmly anchored to prevent flotation, or if they are readily removable from the area within the time available after flood warning.

((O)05-35, Enacted, 10/05/2005)

17-5-3 Standards for Utilities

A. All new or replacement water supply and sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharge from systems into floodwaters.

B. Waste disposal systems shall not be installed in a floodway or in a regulatory floodplain.

((O)05-35, Enacted, 10/05/2005)

17-5-4 Standards and Submital Requirements for Subdivisions

A. All subdivision proposals shall be consistent with the need to minimize flood damage.

B. All subdivision proposals shall have all public utilities and facilities, including but not limited to sewer, gas, electrical, and water systems located and constructed to minimize flood damage.

C. All subdivisions shall provide adequate drainage to reduce exposure to flood hazards (See Adopted Drainage Criteria Manual).

D. Suitability of the Land:

Land that has been found by the Floodplain Board to be unsuitable for development with permanent structures based on hydrological and engineering studies of flooding can be platted and used for only open-space and green-belt uses such as those identified in Section 17-5-7.B.1. This includes land which is:

1. Physically unsuitable because of flooding, poor drainage, and other features which may endanger health, life, or property, aggravate erosion, increase the flood hazard; or increase the burden imposed on the community, its governmental units, and its citizens;

2. Subject to flooding because of its proximity to the stream or watercourse; or because of low elevation. In applying this provision, the Floodplain Board, with technical support and recommendations from the Town Engineer, shall consider:

a. Land subject to flooding by the base flood shall not be platted for residential occupancy, or building sites, or for any other uses that may increase the flood hazard or endanger health, life, or property, unless each lot contains a building site that meets requirements set forth below, in Section 17-5-4G and H, and within other pertinent sections of this ordinance;

b. Fill shall not be used to raise land within the regulatory floodway. In other areas subject to flooding by the base flood, fill may be used provided that the proposed fill does not restrict the flow of water and increase flood heights or velocities in the regulatory floodway,

according to the same standards established for street fill described in Section 17-5-4F.2, and provided that compensatory flood storage is provided.

E. Flood situation to be shown on plat. Plats submitted shall show the following:

1. Tentative development plans and preliminary development plans (plats) shall show the location, by survey, of watercourses, channels, irrigation laterals, private ditches, culverts, lakes, or other water features, including direction of flow, water level elevations, and the location and extent of areas subject to frequent inundation;

2. All preliminary subdivision proposals shall identify the area of special flood hazard, regulatory floodplain, the elevation of the base flood, pre- and post-development water surface elevations, and pre- and post-development floodplain limits.

3. All tentative, preliminary, and final subdivision plans will provide the elevation(s) of proposed structure(s) and pads. If the site is filled above the base flood elevation, the final lowest floor and pad elevation shall be certified by an Arizona Registered Professional Civil Engineer or an Arizona Registered Professional Land Surveyor and provided to the Floodplain Administrator and the Town Building Official.

4. Final and preliminary plats shall show the limits of the regulatory floodplain and the regulatory floodway;

5. Tentative and preliminary plats and plans shall show proposed improvements for areas subject to flooding and/or for areas which contain extremely poor drainage facilities such that the proposed improvements make the areas safe from flooding for the respective type of occupancy.

F. Street Elevations

1. Refer to the Town's adopted Drainage Criteria Manual and Subdivision Street Standards for additional information and requirements.

2. Fill used for the streets in areas subject to flooding shall not increase flood heights more than 1 (one) foot where the owner of the land doing the development owns both sides of the floodway and not more than 0.1 foot where only one side is owned. In no case should the development increase the water surface elevation more than 0.1 foot on the property owned by others upstream and downstream. Fill in regulatory floodplains for streets shall require the same review and permitting process as any other project requesting fill in a regulated floodplain. The aforementioned water surface elevation increases apply to all watercourse channels in Oro Valley except the Canada del Oro Wash where the elevation of the existing levee system and bank protection will allow for no water surface elevation increases due to encroachment. Additionally, when main channel flood-flow velocities are greater than 4.0 feet per second (fps), flood-flow velocities shall not increase by more than 1.0 fps or ten (10) percent, whichever is less, in the regulatory floodway. Any velocity increase greater than the aforementioned criteria must be reviewed and approved by the Town Engineer.

3. The developer shall provide pre- and post-developed water surface elevation for streets proposed for placement in or adjacent to areas subject to flooding. Headwater ponding limits and water surface elevations shall be shown upstream of all culvert crossings.

G. Building Site:

1. Residential lots shall contain a building site, either natural or man-made, which is not subject to flooding by the base flood.

2. In areas subject to flooding by the base flood, where no fill is proposed, the building line shall be located no closer to the watercourse or channel than the edge of the area subject to flooding by the base flood. In areas where fill is used to raise the elevation of the building site, no fill shall be placed in the regulatory floodway, and the building line shall be located no less than twenty five (25) feet landward from the edge of the fill.

H. Setback from Channels:

Along reaches of all regulated watercourses, erosion hazard setback requirements from banks of washes shall be established in accordance with the Town's adopted Drainage Criteria Manual or standards accepted by the Town Engineer.

I. Easements for Drainage:

Whenever any watercourse is located in the area being subdivided, an easement or common area encompassing each side of the watercourse shall be provided for the purpose of protecting and or maintaining the watercourse for flood and drainage purposes, and such further width for construction of bank protection or for allowing for natural meander of the stream or watercourse that may be reasonably expected, or for all these as will be adequate for the purpose, as determined by the Town Engineer.

J. Detention/Retention systems:

See Town's adopted Drainage Criteria Manual for requirements pertaining to Detention/Retention systems by visiting the website townoforovalley.com or the administrative offices at 11000 N. La Canada Drive.

((O)05-35, Enacted, 10/05/2005)

17-5-5 Standards for Manufactured Homes

All manufactured homes that are placed within or substantially improved while located within a regulatory floodplain shall:

A. Be elevated so that the lowest structural member or the lowest point of any attached appliances, whichever is lower, is at or above the regulatory flood elevation; and

B. Be securely anchored to an adequately anchored foundation system to resist flotation, collapse, or lateral movement by one of the methods listed below. This anchoring requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

1. By providing an anchoring system designed to withstand horizontal forces of 25 pounds per square foot and uplift forces of 15 pounds per square foot; or

2. By providing over-the-top and frame ties to ground anchors. Specifically:

a. Over-the-top ties shall be provided at each of the four corners of the manufactured home, with two (2) additional ties per side at intermediate locations - except that manufactured homes less than 50 feet in length shall require only one (1) additional tie per side; and

b. Frame ties be provided at each corner of the home with, five (5) additional ties per side at intermediate points - except that manufactured homes less than 50 feet in length shall require only four (4) additional ties per side; and

c. All components of the anchoring system are capable of carrying a force of 4,800 pounds.

((O)05-35, Enacted, 10/05/2005)

17-5-6 Standards for Recreational Vehicles

All recreational vehicles placed within a regulatory floodplain area will either:

A. Be on site for fewer than 180 consecutive days, and be fully licensed and ready for highway use, to the extent that they are not prohibited by any other ordinance. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions, or

B. Meet the permit requirements of Article 17-4 of this ordinance, and the elevation and anchoring requirements for manufactured homes in Section 17-5-5.

((O)05-35, Enacted, 10/05/2005)

17-5-7 Floodways

Located within regulatory floodplain areas, established in Section 17-3-2, are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of floodwaters that carry debris, potential projectiles, and increase erosion potential, the following provisions apply:

A. Encroachments, including fill, new construction, substantial improvements, and other development are generally prohibited in floodways. The Floodplain Administrator will consider encroachments where certification by a an Arizona Registered Professional Civil Engineer is provided demonstrating that encroachments will result in no increase in flood levels during the occurrence of the base flood discharge, and that the encroachment will not pose a threat to life or property.

B. Floodway Requirements:

1. USES PERMITTED: The following open space uses shall be permitted within a floodway to the extent that they are not prohibited by any other ordinance or state or federal permit requirements, nor conflict with uses permitted in adjoining zones, and provided they do not require structures, fill, or storage of materials or equipment:

a. Agricultural uses, including general farming, pasture, grazing or outdoor plant nurseries, horticulture, viticulture, truck farming, sod farming, wild crop harvesting, and

restoration of native vegetation;

b. Private and public recreational uses;

c. Accessory residential uses, including lawns, gardens, and play areas.

C. LIMITATIONS:

1. No use shall be allowed within a floodway which:

a. Acting alone or in combination with existing or future uses creates a danger or hazard to life or property.

b. Increases the water surface elevation of the base flood;

c. Adversely affects groundwater recharge.

2. No waste disposal systems or septic drain fields shall be installed wholly or partly in a floodway.

D. If Section 17-5-9 is satisfied, all new construction and substantial improvements shall comply with all other applicable flood hazard reduction provisions in Article 17.5.

((O)05-35, Enacted, 10/05/2005)

17-5-8 Floodway Fringe Area Requirements

A. Floodway fringe areas shall be subject to the following regulations:

1. The following uses shall be permitted within a floodway fringe area to the extent that they are not prohibited by any other ordinance but only upon issuance of a Floodplain Use Permit:

a. Any use permitted in Section 17-5-7.

b. Any other use not involving structures, provided it is elevated above the regulatory base flood elevation and a determination is made by the Town Engineer that the use will not increase the base flood elevation more than one (1) foot where the owner of the land doing the development owns both sides of the floodway, and not more than 0.1 foot where only one side is owned. In no case should the development increase the water surface elevation more than 0.1 foot on the property owned by others upstream and downstream, nor unduly restrict the capacity of the channels or floodway of tributaries to the main stream or watercourse, drainage ditches, or other drainage facilities or systems. The aforementioned water surface evaluation increases apply to all watercourse channels in Oro Valley except the Canada del Oro Wash where the elevation of the existing levee system and bank protection will allow for no water surface elevation increases due to encroachment. Additionally, when main channel flood-flow velocities are greater than 4.0 feet per second (fps), a land use/development activity shall not increase flood-flow velocities immediately downstream of the activity by more than 1 fps or ten (10) percent, whichever is less, in the regulatory floodway. Any velocity increase greater than the aforementioned criteria must be reviewed and approved by the Town Engineer.

c. Structures, including dwellings, may be erected or moved provided the first floor or basement floor is placed at or above the regulatory flood elevation. Land may be filled, provided that the top of such fill shall be at or above the regulatory flood elevation for the particular area, and shall extend at such elevations at least twenty-five (25) feet beyond the limits of any structure erected or placed thereon. The placement of structures and any accompanying fill shall not affect base flood elevation beyond the limits set in Section 17-508.A.1.b. above.

B. The following minimum requirements apply in all zones designated on the FIRM, the FHBM, and the floodplain of those watercourses with a base flood flow rate of = 50 cfs:

1. All new construction (including pre-fabricated structures and mobile homes) and substantial improvements shall be anchored to prevent floatation and lateral movement, and be constructed with flood resistant materials and methods.

2. All proposed plats and proposals for other developments, including their utilities, streets, and drainage structures, shall be located and designed to be consistent with the need to minimize flood damage.

3. All tentative, preliminary and final plat proposals, and other proposed new developments shall include base flood elevation data.

4. The Town must be furnished, for permanent record, all elevations and flood-proofing levels for all new or substantially improved structures, whether such structures contain a basement.

5. If in a riverine situation, all adjacent communities and the State Coordinating Office must be notified prior to any alteration or relocation of the watercourse, and copies of such

notifications must be sent to the FIA. Within the proposed altered or relocated portion of any watercourse, the flood carrying capacity shall be maintained.

6. Within one hundred twenty (120) days after completion of construction of any flood control protective works which changes the rate of flow during the flood, or changes the configuration of the floodplain, the person or agency responsible for installation of the protective works shall provide to the governing bodies of all jurisdictions affected by the protective works a new delineation of all floodplains affected. The new floodplain delineation shall be done according to the criteria adopted by the state of Arizona Director of Water Resources.

C. LIMITATIONS:

1. No use shall be allowed within a floodway fringe which:

a. Acting alone or in combination with existing or future uses creates danger or hazard to life or property.

b. Increases the water surface elevation for the base flood;

c. Adversely affects groundwater recharge.

2. No waste disposal systems or septic drain fields shall be installed wholly or partly in a floodway fringe.

((O)05-35, Enacted, 10/05/2005)

17-5-9 Flood Related Erosion-Prone Area

The protection of Town residents and their property from injury and damage that can occur as a result of streambank lateral migration due to erosion and scour is of primary importance in the administration of this ordinance and the following criteria apply:

A. The Floodplain Administrator shall require Floodplain Use Permits for proposed construction and other development within all flood related erosion-prone areas, as determined by lateral migration analysis described in the Town's Drainage Criteria Manual or in other predetermined, documented evidence. Areas generally most susceptible to lateral erosion and scour include, but are not limited to, locations of historical stream/wash meandering, locations where poorly defined or poorly consolidated banks occur, wash reaches characterized by changes in the direction, velocity, or amount of streamflow, and locations in the proximity of stabilizing features or structures such as rock outcrops or bridges.

B. Permit applications shall be reviewed to determine whether the proposed site alterations and improvements will be reasonably safe from flood-related erosion, and will not cause flood-related erosion hazards or otherwise aggravate the existing hazard.

C. If a proposed development or structure including associated permanent features such as a patio wall or swimming pool or any other feature that is attached to the structure is found to be in the path of flood-related erosion, or would increase the erosion hazard, such improvements shall be relocated or adequate protective measures shall be taken to avoid aggravating the existing erosion hazard.

D. Adjacent to all washes with a base flood flow rate 50 cfs, a setback from the wash is required for all new development to create a safety buffer. The setback shall be determined using the method outlined in the Town of Oro Valley Drainage Criteria Manual. The buffer may be used for suitable open space purposes, such as for outdoor recreation and wildlife habitat areas, and for other activities using temporary and portable structures only. The erosion setback shall be calculated streamward from the outer most permanent/fixed feature on the property and this structure or feature constructed in such a manner that it will be protected should lateral channel migration occur to its base.

((O)05-35, Enacted, 10/05/2005)

Article 17-6
APPEAL AND VARIANCE PROCEDURES

Sections:

17-6-1 Nature of Variances

The variance criteria set forth in this section of the ordinance are based on the general principle of zoning law that variances pertain to a piece of property and are not personal in nature. A variance may be granted for a parcel of property with physical characteristics so unusual that complying with the requirements of this ordinance would create an exceptional hardship to the applicant or the surrounding property owners. The characteristics must be unique to the property and not be shared by adjacent parcels. The unique characteristic must pertain to the land itself, not to the structure, its inhabitants, or the property owners.

It is the duty of the Town of Oro Valley to help protect its citizens from flooding. This need is so compelling and the implications of the cost of insuring a structure built below the base flood elevation are so serious (as much as $25 for $100 of insurance coverage) that variances from the base flood elevation shall not be granted. Variances from other requirements in the Floodplain Management Ordinance are quite rare. The long-term goal of preventing and reducing flood loss and damage can only be met if variances are strictly limited. Therefore, the variance guidelines provided in this ordinance are detailed and contain multiple provisions that must be met before a variance can be properly granted. The criteria are designed to screen out those situations in which alternatives other than a variance are more appropriate.

Additionally, A.R.S. 48-3609 (J) states that the land for which the variance is granted shall be ineligible for exchange of State land pursuant to the flood relocation and land exchange program provided for by title 26, chapter 2, article 2. A copy of the notice shall be recorded in the office of the Pima County recorder and shall be recorded in a manner so that it appears in the chain of title of the affected parcel of land. The floodplain administrator shall maintain a record of all variance actions, including justification for their issuance, and report such variances in a biennial report to FEMA and ADWR.

((O)05-35, Enacted, 10/05/2005)

17-6-2 Floodplain Board

A. The Floodplain Board of Oro Valley shall hear and decide requests for variances from the requirements of this ordinance to FEMA regulated floodplains, as well as hear appeals to decisions from previous determinations or actions on non-FEMA regulated floodplains by the Floodplain Administrator or the Town Engineer.

B. The Floodplain Board shall hear and decide appeals when it is alleged there is an error in any requirement, decision, or determination made by the Floodplain Administrator in the enforcement or administration of this ordinance with regard to FEMA regulated floodplains and floodplains identified on the Town's Flood Hazard Boundary Maps.

((O)05-35, Enacted, 10/05/2005)

17-6-3 Appeals and Request for Variance Considerations

A. In passing upon appeals and requests for variance, the Floodplain Board shall consider all technical evaluations, all relevant factors, and all standards specified in other sections of this ordinance, and also consider:

1. The danger that materials may be swept onto other lands to the injury of others;
2. The danger of life and property due to flooding or erosion damage;
3. The susceptibility of the proposed facility and its contents to flood damage, and the effect of such damage on the individual owner;
4. The importance of the services provided by the proposed facility to the community;
5. The necessity to the facility of a waterfront location, where applicable;
6. The availability of alternative locations for the proposed use that are not subject to flooding or erosion damage;
7. The compatibility of the proposed use with existing and anticipated development;
8. The relationship of the proposed use to the comprehensive plan and Floodplain Management Program for the area encompassing the proposed use;
9. The safety of access to the property in time of flood for ordinary and emergency vehicles;
10. The expected heights, velocity, duration, rate of rise, and sediment transport of the floodwaters expected at the site; and,
11. The costs of providing governmental services during and after flood conditions,

including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, water system, and streets and bridges.

B. Upon consideration of the factors of Section 17-6-3A and the purposes of this ordinance, the Floodplain Board may attach such conditions to the granting of appeals and variances as it deems necessary to further the purposes of this ordinance.

C. The Floodplain Administrator shall maintain a record of all variance actions, including justification for their issuance; and shall report any such variances that are issued in FEMA regulated floodplains in its biennial report, which is also, submitted to the Federal Emergency Management Agency.

((O)05-35, Enacted, 10/05/2005)

17-6-4 Conditions for Variances

A. Variances shall only be issued upon:

1. A showing of good and sufficient cause;
2. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief;
3. A determination that failure to grant the variance would result in exceptional hardship to the applicant;
4. A showing that the use cannot perform its intended purpose unless it is located or carried out in close proximity to the wash. This includes only facilities defined in Article 17.2 of this ordinance in the definition of functionally dependent use (which is unlikely due to the Town of Oro Valley's arid climate); and
5. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

B. Variances shall not be issued within any designated regulatory floodway if any increase in regulatory floodway elevation would result during the base flood discharge.

C. Variances may be issued for the repair, rehabilitation, or restoration of structures listed in the National Register of Historic Places or the State Inventory of Historic Places upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure, and that the variance is the minimum necessary in order to preserve the historic character and design of the structure.

D. The Floodplain Administrator, at his/her discretion, may grant a variance for non-FEMA regulated flood hazard areas.

((O)05-35, Enacted, 10/05/2005)

Article 17-7
ORDINANCE AMENDMENTS

Sections:

17-7-1 Procedures

A. The Floodplain Board may from time to time, after a public hearing required by law (ARS 38-431.01, and other Open Meeting Laws), amend, supplement, or change the regulations set forth herein or subsequently established. Any amendment, supplement, or change may be initiated by the Floodplain Board or by petition of affected persons hereafter provided.

B. The procedures established by this Article are to provide for appropriate and timely ordinance amendments, with due consideration of the purpose of this ordinance.

((O)05-35, Enacted, 10/05/2005)

Article 17-8
FEES

Sections:

17-8-1 Fee Schedule

Fees for floodplain use permits will be charged based on the fee schedule approved by the Town Council.

((O)05-35, Enacted, 10/05/2005)

APPENDIX C – TOV STORM WATER ORDINANCE

Article 15-24
STORMWATER

Sections:

15-24-1 Authority

This article may be referred to as the Town of Oro Valley Stormwater Utility Ordinance. This article is adopted pursuant to ARS 9-521, which defines stormwater as a utility undertaking, and ARS 9-522, which authorizes the Town to issue bonds and prescribe service charges so that a utility undertaking for which bonds are issued will always remain self-supporting with revenue sufficient to repay bonds and provide for the expenses of operation, maintenance, expansion and replacement of facilities.
(01-15, Added, 06/20/2001)

15-24-2 Need and Purpose

A. The occurrence of storms and other events that may cause periodic flooding of land. Such periodic flooding, in sound engineering practice, requires the planning, design, construction, operation, and maintenance of facilities that safely drain and control the quantity and quality of runoff from such storms and other events.

B. The purpose of this article is to provide for the creation of the Town of Oro Valley Stormwater Utility and to adopt appropriate funding mechanisms and service charges to provide the needed stormwater facilities.
(01-15, Added, 06/20/2001)

15-24-3 Area of Jurisdiction

The Stormwater Utility applies to all areas within the incorporated limits of the Town.
(01-15, Added, 06/20/2001)

15-24-4 "Town-Owned Stormwater Utility ("Enterprise")"

A. The Stormwater Utility shall constitute an enterprise of the Town. The Town, may issue its own revenue bonds or other obligations (including refunding securities) on behalf of the Town. The revenue bonds or other obligations shall be payable solely from the net revenues derived from the operation of the Stormwater Utility. Such revenue bonds or other obligations may be additionally secured by mortgages on or security interest in any real or personal property of the Town used in the operation of the Stormwater Utility. The ordinance issuing any such revenue bonds or other obligations shall be adopted in the same manner and shall be subject to referendum to the same extent as any ordinance of the Town in accordance with

Arizona law.

B. Any pledge of net revenues derived from the operation of the Stormwater Utility shall be subject to limitations on future pledges thereof contained in any ordinance authorizing the issuance of outstanding bonds or other obligations of the Town payable from the same source or sources. All bonds or other

obligations issued by ordinance payable from the net revenues derived from the operation of the Stormwater Utility and all revenue bonds or other obligations of the Stormwater Utility payable solely from the net revenues derived from the operation of the Stormwater Utility, shall be treated as having the same obligor and as being payable in whole or in part from the same source or sources.

C. The Stormwater Utility shall also be authorized to have and exercise the following powers in furtherance of its purpose: 1) to hold meetings concurrently with regular and special meetings of the Town Council; 2) to have and use a seal; 3) to issue its revenue bonds for stormwater purposes in the manner in which Town revenue bonds may be issued; 4) to pledge any revenues of the Town's stormwater system to the payment of such revenue bonds and to pay such revenue bonds therefrom; 5) to enter into contracts relating to the stormwater system in the manner in which Town contracts may be entered into; 6) to make representations, warranties, and covenants relating to the stormwater system on behalf of the Town; 7) to exercise rights and privileges of the Town relating to the stormwater system; and 8) to bind the Town to perform any obligation relating to the stormwater system other than the multiple-fiscal year direct or indirect debt or other financial obligation(s) of the Town without adequate present cash reserves pledged irrevocably and held for payments in all future years.

D. All revenues and expenditures of the Town, or of the Stormwater Utility relating to the stormwater system, shall be considered revenues and expenditures of the Stormwater Utility.

(01-15, Added, 06/20/2001)

15-24-5 (Reserved)

(Reserved).

(01-15, Added, 06/20/2001)

15-24-6 Stormwater Utility Commission

There is hereby established an entity to be called the Town of Oro Valley Stormwater Utility Commission. The Commission shall be comprised of five (5) Oro Valley residents, and the Mayor and Council shall appoint the members.

(01-15, Added, 06/20/2001)

15-24-7 Director of Administration

The Public Works Director, or designee, shall serve as the Administrator of the Stormwater Utility.

(01-15, Added, 06/20/2001)

15-24-8 Adoption of Stormwater Management Plan

The Stormwater Utility shall adopt a comprehensive Stormwater Management Plan in conformance with the Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) Phase II guidelines (40 C.F.R. 9.122-125). The Stormwater Management Plan shall outline the goals and objectives of the stormwater system and identify the various elements of the system necessary to achieve the goals and the associated costs in accordance with generally accepted hydrology practices.

(01-15, Added, 06/20/2001)

15-24-9 Facilities

All stormwater conveyance facilities owned by or dedicated to the Town within the area of jurisdiction shall be considered the facilities of the Stormwater Utility. Stormwater conveyance facilities constructed as a part of private development shall not be dedicated to the public unless a request is made of the Town to accept dedication of such facilities and the Administrator determines that the facilities are constructed to current Town standards and that

it is in the public interest to accept such dedication. Such facilities and/or interests in real property shall not be conveyed to the Town prior to the issuance of a formal acceptance by the Town.
(01-15, Added, 06/20/2001)

15-24-10 Reserve Funds

The Stormwater Utility shall maintain reserve funds for unexpected and/or emergency needs. The need for use of said funds shall be determined by the Board with recommendations from the Commission, or in the case of an emergency where the Commission can not be convened in a timely manner, with recommendation from the Director. This reserve shall be fifteen percent (15%) of the collected annual stormwater fees.
(01-15, Added, 06/20/2001)

15-24-11 Disclaimer

Floods from stormwater runoff may occasionally exceed the capacity of stormwater facilities constructed and maintained pursuant to this article. This article does not denote that property liable for the fees and charges established by this article would always be free from stormwater flooding or flood damage. This article does not purport to reduce the need or the necessity for the property owners to obtain flood insurance. This article does not create any liability on the part of the Town or any officer or employee thereof for any damages that may result from reliance on this article or actions of the Stormwater Utility. This article, other than as provided for in this section, does not relieve any person from liability for actions taken, or not taken, for damage to persons or the property of others.
(01-15, Added, 06/20/2001)

15-24-12 Rules of Interpretation

Nothing in this article shall be construed to limit or repeal other powers granted to the Town. Should provisions of this article conflict or overlap with other regulations, ordinances, or statutes, the regulation, ordinance, or statute that imposes the more stringent requirement or restriction shall prevail.
(01-15, Added, 06/20/2001)

15-24-13 Stormwater Utility Fee System

A. **Findings.**

1. The Town maintains a system of storm and surface water management facilities including, but not limited to, inlets, conduits, manholes, channels, ditches, drainage easements, retention and detention basins, infiltration facilities, and other components as well as natural waterways.
2. The stormwater system in the Town needs regular maintenance, repair and improvements.
3. Stormwater quality is degraded due to erosion and the discharge of nutrients, metals, organic compounds including oil and grease, and other substances into and through the stormwater system.
4. Stormwater quantity is affected by erosion, design of drainage, maintenance of stormwater channels, channel vegetation, floodway and flood plain characteristics and changes, and deposition of material in the channels.
5. The public's health, safety, and welfare are adversely affected by poor stormwater quality and flooding that result from inadequate management of both the quality and quantity of stormwater.
6. All real property in the Town either uses or benefits from the maintenance of the stormwater system.
7. The extent of use of the stormwater system by each property is dependant on factors that influence runoff, including land use and the amount of impervious surface on the property.
8. The costs of improving, maintaining, repairing, operating, and monitoring the stormwater system shall be allocated, to the extent practicable, to all property owners based on the impact of runoff from the impervious areas of their property on the stormwater control and conveyance system.

9. Management of the stormwater system to protect the public health, safety, and welfare as well as meet the Arizona Pollutant Discharge Elimination System Phase II permit and FEMA requirements requires adequate revenues. It is in the interest of the public to finance stormwater management with a fee system that is reasonable and equitable. Single-family residences will be charged a flat rate for one (1) ERU. Non-single-family and religious/educational property owners will be charged a multiple rate equal to the amount of impervious area on their property divided by the amount of one (1) ERU (five thousand (5,000) square feet). This formula will charge property owners on the basis of their properties' impact to the stormwater system.

B. **Authority.** Authority for the adoption of a system of charges to fund the implementation of stormwater management programs is conferred on the Town by ARS 9-530, as amended.

C. **Definitions.** For the purposes of this chapter, the following words and phrases shall have the meanings indicated:

1. "Administrator of the Stormwater Utility" or "Administrator" means the Town Engineer, or designee, shall serve as the Administrator of the Stormwater Utility.

2. "Arizona Pollutant Elimination Discharge System (AZPDES)" means a program required under Section 402(b) of the Clean Water Act (CWA), in accordance with 40 CFR 123.22. The program specifies how the Arizona Department of Environmental Quality (Department) will administer the National Pollutant Discharge Elimination System (NPDES) program. The program is found in Article (3.1) of the Arizona Revised Statutes in Chapter 2, under Title 49 authorizing a state NPDES program. The administrative rules for an Arizona Pollutant Discharge Elimination System (AZPDES) program are consistent with, but no more stringent than, the NPDES program and the requirements of Sections 402(b) (state permit programs) and 402(p) (municipal and industrial stormwater discharges) of the CWA.

3. "Equivalent residential unit (ERU)" means approximate average amount of impervious area associated with single-family residential property in the Town.

4. "Base rate (BR)" means the Stormwater Utility flat fee to an ERU of five thousand (5,000) square feet of impervious surface.

5. "Commission" means the Stormwater Utility Commission for the Town of Oro Valley established under this article.

6. "Developed property" means real property which has been altered from its structures, or other impervious area.

7. "Undeveloped property" means real property in its untouched natural state.

8. "Fee" or "Stormwater Utility fee" means the charge established under this section and levied on owners of parcels or pieces of real property to fund the costs of stormwater management, implementation of the Stormwater Management Plan together with constructing, operating, maintaining, repairing, and improving the stormwater system in the Town.

9. "FEMA" means the Federal Emergency Management Agency.

10. "Fiscal year" means July 1st of a calendar year to June 30th of the next calendar year, both inclusive.

11. "Impervious surface area" means the number of square feet of horizontal surface covered by buildings and other impervious surface, which is compacted or covered with material that is resistant to infiltration by water, including, but not limited to, most conventionally surfaced streets, roofs, sidewalks, patios, driveways, parking lots, and any other oiled, graveled, graded, compacted, or other surface that impedes the natural infiltration of surface water.

12. "Multifamily dwelling" means a building with more than three (3) dwelling units (to include apartments and condominiums).

13. "Nonresidential property" means developed property other than single-family residential property. Such property shall include, but not be limited to, multifamily dwellings, commercial properties, industrial properties, parking lots, hospitals, recreational and cultural facilities, hotels, and offices.

14. "Educational facilities, religious institutions and nonprofits" means any developed public, private, or parochial school or any building recognized as a religious facility or nonprofit use.

15. "Property owner" means the property owner of record as listed in the Pima County Assessor's roll. A property owner includes any individual, corporation, firm, partnership, or group of individuals acting as a unit, and any trustee, receiver, or personal representative.

16. "Single-family residential property (SFR)" means a developed property that serves the primary purpose of providing a permanent dwelling unit. Single-family residential property

shall also include duplexes and triplexes. A single-family detached dwelling containing an accessory apartment or second dwelling unit is included in this definition.

17. "Stormwater utility fund" or "fund" means the fund created by this chapter to operate, maintain, repair, and improve the Town's stormwater system and implement the Town's Stormwater Management Plan.

18. "Stormwater Management Plan" means the planning, design, construction, regulation, improvement, repair, maintenance, operation of facilities and programs necessary for the Town to meet the compliance requirements of the Arizona Pollutant Discharge Elimination System (AZPDES) Phase II Municipal General Permit and FEMA Regulations as relating to water, flood plains, flood control, grading erosion, and sediment control along those activities.

19. "Stormwater system" means the system or network of storm and surface water facilities including but not limited to inlets, conduits, manholes, channels, ditches, drainage easements, retention and detention basins, infiltration facilities and other components as well as all natural waterways (including washes). It shall also mean the activities associated with implementing the Stormwater Management Plan.

20. "Water" means any stormwater, surface water, snow melt or ground water.

D. **Establishment of Stormwater Utility Fund.**

1. The Stormwater Management Plan is established to provide for the Town's compliance with the AZPDES Phase II Municipal General Permit requirements and to provide the stormwater system necessary to convey stormwater, control flooding, and to protect the natural environment. The costs of complying with the AZPDES Phase II program and FEMA Regulations along with designing, developing, improving, operating, maintaining, and monitoring the stormwater system required in the Town should, therefore, be allocated, to the extent practicable, to all property owners based on their impact on the stormwater system. In order to provide revenue to fund those costs and to fairly allocate those costs, a Stormwater Utility Fund (the "fund") is established.

2. All revenues collected from the Stormwater Utility fee, from grants, permit fees, penalties and other charges collected under this article, shall be deposited to the fund. The Town Council may make additional appropriations to the fund. All disbursements from the fund shall be for the purposes of the fund as set forth in subsection E of this section, and the fund shall be used for those purposes only.

E. **Purposes of the Fund.** The fund shall be used for the following purposes:

1. All costs of implementation and administration of the Stormwater Management Plan, including the establishment of reasonable operating and capital reserves to meet unanticipated or emergency stormwater management requirements. There shall be a reserve fund of fifteen percent (15%) of the collected annual stormwater fees as specified under Section 15-24-10 of this code.

2. Inspection and enforcement activities.

3. Billing and administrative costs.

4. Other activities that are reasonably required to accomplish the mission of the Stormwater Management Plan.

F. **Stormwater Utility Fee.** A monthly service charge is imposed upon all real property in the Town, as of the first day of each month, beginning January 1, 2008, to fund the Stormwater Management Plan and stormwater system with invoicing as defined in subsection J of this section. This service charge shall be known as the Stormwater Utility fee ("fee"). As any real property is developed or developed real property is annexed into the Town it will be subject to the fee. The fee is based on the cost of implementing a stormwater management program.

G. **Classification of Property for Purposes of Determination of the Stormwater Utility Fee.**

1. For purposes of determining the Stormwater Utility fee, all properties in the Town are classified into one of the following classes:

   a. Single-family residential property; or
   b. Nonresidential property; or
   c. Educational facilities, religious institutions and nonprofits.

2. Single-Family Residential (SFR) Fee. All developed single-family residential properties in the Town shall be charged a flat Stormwater Utility fee, equal to the base rate, regardless of the size of the parcel or the improvements.

3. Non-Single-Family Residential Property (NSFR) Monthly Fee. A developed non-single-family residential (NSFR) property will be charged a fee for the number of ERUs of

impervious area. The impervious area for developed NSFR property may be determined through site examination, mapping information, aerial photographs and other available information. NSFR without first flush capabilities or other approved stormwater pollution prevention devices shall pay the base rate times the number of ERUs on the site. The monthly fee shall be determined by dividing the total impervious surface (in square feet) by five thousand (5,000) and rounding that value up or down to the nearest whole ERU amount and then multiplying the result by the base rate to obtain the monthly fee. NSFR properties that incorporate first flush capabilities or other approved stormwater pollution prevention devices are eligible for a twenty-five percent (25%) reduction in the fee, providing they apply to and are approved by the Stormwater Utility Commission and meet the annual inspection and maintenance requirements.

4. Educational Facilities, Religious Institutions and Nonprofits Monthly Fee. A developed religious institution, school or other non-profit property shall be eligible for a twenty-five percent (25%) fee reduction provided they apply to and are approved by the Stormwater Utility Commission. In order to qualify for the fee reduction, the educational facility, religious institution or non-profit organization must conduct educational programs or other tasks on the topic of stormwater management as approved by the Stormwater Utility Commission. No developed educational facility, religious institution or nonprofit property shall pay less than seventy-five percent (75%) of the base rate. The monthly fee shall be determined by dividing the total impervious surface (in square feet) by five thousand (5,000) and rounding that value up or down to the nearest whole ERU amount and then multiplying the result by the base rate to obtain the monthly fee.

H. **Base Rate.**

1. The Town Council shall, by resolution, establish the annual (fiscal year) monthly base rate for the Stormwater Utility fee. The base rate shall be calculated to ensure adequate revenues to fund the costs of stormwater management and to provide for the operation, maintenance, and capital improvements of the stormwater system in the Town.

2. A schedule of fees shall be maintained by the Stormwater Utility, three (3) copies of which shall be available at the Town Clerk's office.

3. The Stormwater Utility Commission shall annually review the Stormwater Utility revenue requirements and recommend to the Town Council rate adjustments as necessary.

I. **Exemptions.**

1. Property which is owned by the Town and other governmental agencies shall be exempt from the fee.

2. Undeveloped property shall be exempt from the fee.

J. **Billing.**

1. Each property served by the Oro Valley Water Utility shall be billed monthly for the Stormwater Utility fee. Properties not served by the Oro Valley Water Utility shall be billed quarterly. The bill may be part of the Oro Valley Water Utility bill, a separate billing, or some other reasonable mechanism.

2. Service charges shall begin January 1, 2008, with invoicing at the end of the month or quarter, as appropriate.

K. **Stormwater Utility Fee Payable Date; Interest Amount; Lien on Real Property; Abatement of Small Amounts Due.**

1. The invoiced fee is due within thirty (30) days from the date that the bill is issued to the property owner and is overdue after that date. Late fees will be charged in accordance with the Oro Valley Water Utility's delinquency policy.

2. Any fee, including interest, when overdue, is a lien on real property and may be collected in the same manner as delinquent Oro Valley Water Utility fees.

3. The Stormwater Utility Administrator may abate the fee, including interest, if the cost of collection is estimated to exceed the amount of the fee, including any interest due.

L. **Requests for Correction of the Stormwater Utility Fee.**

1. A property owner may request correction of the fee by submitting the request in writing to the Stormwater Utility Administrator. Grounds for correction of the fee include:

   a. Incorrect classification of the property for purposes of determining the fee;
   b. Errors in the square footage of the impervious surface area of the property;
   c. Mathematical errors in calculating the fee to be applied to the property; and
   d. Errors in the identification of the property owner of a property subject to the fee.

2. The Stormwater Utility Administrator shall make a determination within thirty (30) days after the receipt of (as indicated by the receipt date stamp) the property owner's

completed written request for correction of the fee. The applicant may appeal the Administrator's determination to the Stormwater Utility Commission.

3. A property owner must comply with all rules and procedures adopted by the Town when submitting a request for correction of the fee and must provide all information necessary for the Stormwater Utility Administrator to make a determination on a request for correction of the fee. If a property owner alleges an error under subsection (L)(1)(b) of this section, the request for correction must include a certification by a registered civil engineer or professional land surveyor of the impervious surface area of the property. Failure to comply with the provisions of this subsection shall be grounds for denial of the request.

((O)07-40, Added, 11/07/2007)

15-24-14 Stormwater Management and Discharge Control

A. **Title.** This section shall be known as the "Storm Water Quality Management and Discharge Control Ordinance" of the Town of Oro Valley and may be so cited.

B. **Purpose and Intent.** The purpose and intent of this section is to ensure the health, safety, and general welfare of citizens, and protect and enhance the water quality of watercourses and water bodies in a manner pursuant to and consistent with the Federal Clean Water Act (33 U.S.C. 1251 et seq.), National Pollutant Discharge Elimination System Regulations (40 CFR Part 122), and State regulations for stormwater discharge (ARS Title 49, Chapter 2, Article 3.1) by establishing minimum stormwater management requirements for the management of pollutants that are or may be discharged to the municipal storm sewer system.

C. **Definitions.** The terms used in this section shall have the following meanings:

1. *ADEQ* means the Arizona Department of Environmental Quality, Arizona's regulatory entity responsible for administering Federal and State environmental laws and programs including most water-quality, air-quality, and waste programs.

2. *Authorized Representative* means the Town Engineer, or his/her designee, who has the delegated duties and powers pursuant to this section.

3. *AZPDES* means the Arizona Pollutant Discharge Elimination System.

4. *AZPDES Permit* means any permit issued by the ADEQ pursuant to 33 U.S.C. 1342(b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable to an individual, a group, or on a general area-wide basis.

5. *Best Management Practices (BMPs)* means activities, practices, and procedures to prevent or reduce the discharge of pollutants directly or indirectly to the municipal storm drain and ephemeral wash systems and waters of the United States. BMPs include but are not limited to: treatment facilities, including first-flush technology, to remove pollutants from stormwater; public education and involvement; operating and maintenance procedures; facility management practices to control runoff, spillage or leaks of nonstormwater, waste disposal, and drainage from materials storage; erosion and sediment control practices; and the prohibition of specific activities, practices, and procedures and such other provisions as the Town determines appropriate for the control of pollutants.

6. *Certified Industrial Hygienist* means a professional industrial hygienist who is certified by the American Board of Industrial Hygiene.

7. *Clean Water Act* means the Federal Water Pollution Control Act amendments of 1972 (P.L. 92-500; 86 Stat. 816; 33 U.S.C. 1251 through 1376), as amended.

8. *Construction Activity* means activities subject to the ADEQ construction general permit (AZG2008-001) and the Town of Oro Valley's grading permit requirements.

9. *Connection* means the location/juncture at which discharge can enter a municipal separate storm sewer or ephemeral wash system.

10. *Corrective Action Plan* means a plan that is required under this section and approved by an authorized representative that consists of structural and/or nonstructural BMPs to minimize to the maximum extent practicable stormwater pollution or to remediate anthropogenic impacts to the storm-drain/wash system.

11. *De Minimus Discharge* means a discharge that is a low flow volume and/or low frequency, seldom occurring, event of relatively pollutant-free water which is discharged with appropriate BMPs to reduce any pollutant concentrations to below the applicable surface standard (A.A.C. Title 18, Chapter 11, Article 1).

12. *Discharge* means any addition of any pollutant to waters of the United States or to an MS4 from any point source.

13. *Discharger* means any person who causes or allows a discharge or who owns

property from which a discharge originates.

14. *Engineer* means a professional civil engineer who is registered with the State of Arizona.

15. *Environment* means navigable waters, any other surface waters, ground water, drinking water supply, land surface, subsurface strata, ambient air, biotic community, or wildlife habitat within or bordering on the Town.

16. *EPA* means the United States Environmental Protection Agency charged with primary enforcement of the Clean Water Act.

17. *First-Flush* means a collection system approved by the Town that is employed to capture and isolate the first one-half (1/2) inch runoff from the commercial development site.

18. *Illicit/Illegal Discharge* means any direct or indirect nonstormwater discharge to the Town's storm drain or wash systems, or placement of anthropogenic materials in the preceding systems, except as exempted in subsection (H)(1) of this section or discharges pursuant to and in compliance with an applicable NPDES or AZPDES permit or other written authorization from the U.S. Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ).

19. *Industrial Facility* means the site of any industrial activity regulated under NPDES or AZPDES industrial stormwater permits as defined in 40 CFR Section 122.26(b)(14).

20. *Land Disturbance Activity* means any activity that is regulated under NPDES or AZPDES stormwater permit requirements for construction sites.

21. *Municipal Separate Storm Sewer System (MS4)* means all separate storm sewers defined as "large," "medium," or "small" municipal separate storm sewer systems or any municipal separate storm sewers on a system-wide or jurisdiction-wide basis as determined by the Director under A.A.C. R28-9-C902(A)(1)(g)(i) through (iv). [A.A.C. R18-9-A901(23)]. This also includes similar systems owned or operated by separate storm sewer municipal jurisdictions not required to obtain stormwater discharge authorization.

22. *National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permits* means general, group, and individual stormwater discharge permits which regulate facilities defined in Federal NPDES regulations pursuant to the Clean Water Act.

23. *Notice of Intent (NOI)* means a document which describes the intent to operate in accordance with an NPDES/AZPDES Construction General Permit.

24. *Notice of Termination (NOT)* means the document to terminate coverage under the NPDES/AZPDES Construction General Permit.

25. *Nonstormwater Discharge* means any discharge to the storm drain and wash system that does not originate from precipitation.

26. *Owner or operator* means any owner or operator of any "facility or activity" subject to regulation under the NPDES/AZPDES program.

27. *Person* means an individual, property owner, firm, partnership, joint venture, association, corporation, estate, trust, receiver, syndicate, broker, the Federal Government, the State of Arizona, or any political subdivision or agency of this State.

28. *Point Source* means any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel or other floating craft from which pollutants are or may be discharged. This does not include return flows from irrigated agriculture or agricultural stormwater runoff.

29. *Pollutant* means sediment, fluids, contaminants, toxic wastes, toxic pollutants, dredged spoil, solid waste, substances and chemicals, pesticides, herbicides, fertilizers and other agricultural chemicals, incinerator residue, sewage, garbage, sewage sludge, munitions, petroleum products, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt (e.g., overburden material), and mining, industrial, municipal and agricultural wastes or any other liquid, solid, gaseous or hazardous substances. [A.R.S. Section 49-201(29)]

30. *Pollution* means the human-made or human-induced alteration of the quality of waters by waste to a degree which unreasonably affects, or has the potential to unreasonably affect, either the waters for beneficial uses or the facilities which serve these beneficial uses.

31. *Premises* means any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

32. *Stormwater* means stormwater runoff, snow melt runoff, and surface runoff and drainage.

33. *Stormwater Pollution Prevention Plan (SWPPP)* means a document required under

NPDES/AZPDES regulations or imposed pursuant to this section that describes the stormwater quality controls in place at a site and how these controls will be inspected and maintained.

34. *Town* means the Town of Oro Valley.

35. *Watercourse* means any drainage channel, wash, road or path through which water can flow.

36. *Waters of the United States (U.S.)* is defined in 40 CFR 122.2.

D. **Applicability.** This section shall apply to all activities which may potentially affect the municipal separate storm sewer system, any private storm sewer system, or any wash system on any land within the Town. Additionally, this includes discharge from permanent or temporary stormwater management controls and facilities, constructed as part of any activities listed in this section, which are located within the Town. Stormwater management standards shall apply to industrial, commercial, institutional, and multi-family residential development, as well as subdivision, roadway, and drainage projects that result in land area disturbance equal to or greater than areas established by the current construction general permit.

E. **Responsibility for Administration.** The Town Engineer shall adopt, administer, implement, and enforce such rules, regulations, standards, processes, and forms as he/she deems necessary for the efficient administration and enforcement of the provisions of this section. Any powers granted or duties imposed upon the Town Engineer/Public Works Director may be delegated to persons or entities acting in the beneficial interest of or in the employ of the Town.

F. **Regulatory Consistency.** This section shall be construed to assure consistency with the requirements of the Federal Clean Water Act and acts amendatory thereof or supplementary thereto, or any applicable implementing regulations including those set forth in the Arizona State permit, and any amendments to, revisions of, or re-issuance thereof. No permit or approval issued pursuant to this section shall relieve a person of the responsibility to secure permits and approvals required for activities regulated by any other applicable code, rule, act, or ordinance. Additionally, the Town does not certify or take any position whether the applicant has met all requirements of the Federal Clean Water Act.

G. **Ultimate Responsibility of Discharger.** The requirements set forth herein and promulgated pursuant to this section are intended to meet minimum standards as required by Federal and State regulations but can, as determined by the Town Engineer, exceed the minimum standards. This section does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants into waters of the U.S. caused by said person. This section shall not create liability on the part of the Town or any agent or employee thereof for any damages that may result from any discharger's reliance on this section or any administrative decision lawfully made thereunder.

H. **Discharge Prohibitions and Controls to Reduce Pollutants Entering Drainage Systems.**

1. General Requirements.

a. Any person engaged in activities which will or may result in pollutants entering a storm sewer system shall undertake appropriate measures to reduce such pollutants. Examples of such activities include, but are not limited to, proper use and disposal of household chemicals, such as pesticides and fertilizers, cleaning solutions, and cleaning solution waste water; and ownership and use of facilities which may be a source of pollutants including but not limited to parking lots, gasoline stations, industrial facilities, construction sites, and retail establishments.

b. No person shall throw, deposit, leave, maintain, keep, or permit to be thrown, deposited, placed, or left unmaintained any refuse, rubbish, garbage, vegetation trimmings, or other discarded or abandoned objects, articles, and accumulations, in or upon any street, alley, sidewalk, storm drain, inlet, catch basin, conduit or other drainage structures, parking area, or upon any public or private plot of land so that the same might be or become a pollutant, except where such pollutant is being temporarily stored in properly contained waste receptacles or is part of a well-defined compost system.

2. Prohibition of Illegal Discharges.

a. No person shall discharge or cause to be discharged into the municipal separate storm sewer system (MS4) or Town watercourses any materials, including but not limited to pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater or pumped or rising unpolluted

ground water. Additionally, depositing, dumping, or storing any material in a manner that may contribute pollutants to or obstruct the flow of stormwater is prohibited. The following activities are also subject to and enforceable under this section as they can contribute to contaminants which are regulated by Federal and State regulations to which this section applies:

i. Failing to comply with any applicable AZPDES/NPDES permit including any permit requirements to develop, implement, maintain or comply with a stormwater pollution prevention plan (SWPPP);

ii. Failing to provide required information to the Town including:

(A) Copies of the SWPPP, notice of intent, notice of termination, or any other documents relating to the permit;

(B) Upon request, copies of the SWPPP, water quality monitoring laboratory analytical results, and/or final hydrologic reports/development plans certifying compliance with any discharge detention or first-flush treatment requirements;

iii. Failing to develop, implement, or comply with a SWPPP or a corrective action plan utilizing BMPs that is either required under an AZPDES/NPDES permit or imposed by the Town pursuant to this section, including requirements to implement good housekeeping practices, spill control and response procedures, employee training, record keeping, proper material storage and waste management practices for control of nonstormwater flows, and structural stormwater controls; and

iv. Misrepresentation in any document pertaining to an approved plan, permit, or certification relating to a discharge activity.

b. The commencement, conduct, or continuance of any illegal discharge to the Town's MS4 is prohibited except as follows:

i. Discharges from the following activities will not be considered a source of pollutants to the Town's MS4 including any waters of the U.S. when properly managed to ensure that potential pollutants are minimized to the maximum extent practicable, and therefore they shall not be considered illegal discharges unless determined to cause a violation of the provisions of the Clean Water Act, ADEQ AZPDES General Permit No. AZG-2001-0001, "General Waste Discharge Requirements for Discharges to Waters of the U.S. Which Pose a Limited or an Insignificant (De Minimus) Threat to Water Quality" (including amended or reissued permits):

(A) Potable water line flushing;

(B) Uncontaminated pumped groundwater and other discharges from potable water sources;

(C) Diverted stream flows;

(D) Air conditioning condensation;

(E) Uncontaminated non-industrial roof drains;

(F) Individual residential and occasional noncommercial car washing;

(G) Flows from riparian habitats;

(H) Dechlorinated swimming pool discharges with the exception of filter back wash water;

(I) Street wash waters;

(J) Flows from fire fighting;

(K) Irrigation water;

(L) Foundation and footing drains;

(M) Water from sump pumps; and

(N) Dust control water.

ii. The prohibition shall not apply to any nonstormwater discharge permitted under an NPDES/AZPDES permit, waiver, or waste discharge order issued to the discharger and administered by the State of Arizona under the authority of the U.S. EPA; provided, that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations; and provided, that written approval has been granted by the Town for any discharge to the storm sewer system.

iii. With written concurrence of the Arizona Department of Environmental Quality, the Town may exempt in writing other nonstormwater discharges which are not a source of pollutants to the storm sewer system or waters of the U.S. Such authorization from ADEQ or the U.S. EPA shall be submitted to the Town prior to the time of discharge, and must be retained for at least three (3) years after the last authorized discharge.

3. Discharges in Violation of Industrial or Construction Activity NPDES Storm Water Discharge Permit. Any person subject to any type of NPDES or AZPDES water or stormwater

discharge permit shall comply with all provisions of such permit. Such compliance includes but is not limited to implementing BMPs to minimize the chance of pollutant entry into the storm sewer system, to reduce the potential for accidental discharge of pollutants to the municipal storm sewer system, and to comply with the cleanup and notification requirements of this section as well as other pertinent Federal/State regulations. Proof of compliance with said permit may be required in a form acceptable to the Town Engineer/Public Works Director prior to or as a condition of a grading permit, subdivision plat, development plan, building permit, or grading or improvement plan; upon inspection of the facility; during any enforcement proceeding or action; or for any other reasonable cause.

I. **Requirement to Prevent, Control, and Reduce Stormwater Pollutants from Construction Sites.**

1. Basic Requirements. All persons engaged in construction activities that are required by Federal or State law to submit to the EPA and/or the ADEQ a notice of intent (NOI) to comply with NPDES or AZPDES stormwater permit regulations shall provide the Town with a copy of the NOI, the site-specific SWPPP, and the AZPDES stormwater permit issued by the ADEQ. Any person performing construction who has submitted an NOI to the Town shall not cause or contribute to a violation of the AZPDES stormwater permit issued to the Town.

2. Authorization to Adopt and Impose Best Management Practices. The Town Engineer/Public Works Director has the final authority to require and accept BMPs as required for pre- and post-construction activities and must be presented in a SWPPP that is included as a section in the plans and permits submitted for Town review and acceptance as well as BMPs that are submitted as a part of corrective action plans. Town acceptance of a SWPPP is required prior to issuance of a grading permit.

3. Every owner, operator, or contractor undertaking any construction activity or operation of any industrial facility having the potential to discharge pollutants to a water of the U.S. or the Town's MS4, or as otherwise required by the Town, the State of Arizona, or Federal agency, shall submit a stormwater pollution prevention plan (SWPPP) to the Town. The SWPPP shall include BMP plans including those required by the Town such as the installation of first-flush technology at commercial sites and shall be prepared by a qualified person. Additionally, SWPPPs shall be prepared and reviewed in accordance with the Arizona Pollutant Discharge Elimination System construction general permit issued by the ADEQ. The Town shall not certify or take any position on whether the applicant has met the requirements of the Federal Clean Water Act.

4. New Development and Redevelopment. Owners of new development and redevelopment projects shall implement BMPs to control the volume, rate, and potential pollutant load, including sediment, of stormwater runoff from new development and redevelopment projects as may be appropriate to minimize the generation, transport and discharge of pollutants including sediment in accordance with the requirements of the AZPDES construction general permit. The Town shall incorporate such requirements in the conditions of relevant development and/or plat approvals as well as grading or other construction/building-related permit to be issued relative to such development or redevelopment. Additionally, proof of all applicable Town, State, and Federal permits such as the SWPPP, NOIs, inspection and maintenance logs, CWA 404s, etc., shall be maintained on site for inspection by authorized representatives. To maintain compliance with construction general permit requirements for inspections, construction site BMPs as delineated in the SWPPP must be inspected by the site operator in accordance with the SWPPP.

5. Responsibility to Implement Best Management Practices. Any person engaged in activities or operations, or owning facilities or property which will or may result in pollutants entering stormwater, the Town's MS4, or waters of the U.S. shall implement best management practices including first-flush control technology on commercial development to the extent they are technologically achievable to prevent and reduce such pollutants. The owner or operator of a commercial or industrial establishment shall provide reasonable protection from accidental discharge of prohibited materials or other wastes into the MS4 or watercourses. Facilities to prevent accidental discharge of prohibited materials or other wastes shall be provided and maintained at the owner's or operator's expense. Furthermore, notices to employees containing information about whom to contact and what procedures to follow in the event of a spill or accidental discharge must be posted at the site. Site owners or operators shall have a trained employee or staff member who will be responsible for any necessary cleanup or remediation.

6. In the event of a spill or release in reportable quantities as defined in 40 CFR 302, 40

CFR 110 and 40 CFR 117, the owner, operator, or the person who has control of the source or location from which a discharge which is not in compliance with this section shall immediately take all reasonable safety precautions including, if appropriate, calling 911 and completing the following steps:

a. Proceed with containment and cleanup in accordance with:

i. The orders of an involved health and safety agency, or if no such orders have been issued;

ii. The orders of an authorized representative, or if no such orders have been issued;

iii. The stormwater pollution prevention plan or approved corrective action plan utilizing best management practices for the involved facility;

b. Report any violations of the Town fire code or other such applicable safety or health codes in the manner required by such code;

c. Notify the Oro Valley Town Engineer/Public Works Director and the Arizona Department of Environmental Quality of the release by telephone before 5:00 p.m. of the next working day;

d. Provide written notification, within five (5) working days, to the Oro Valley Town Engineer/Public Works Director of the type, volume, cause of the discharge, corrective actions taken, and measures to be taken to prevent future occurrences.

7. Compliance with these requirements shall not relieve the discharger of any fines, penalties, or liability incurred, or that may be imposed by this section or other applicable laws as a result of the discharge. In addition, compliance with these requirements shall not relieve the discharger from the reporting requirements of 40 CFR 110, 40 CFR 117 and 40 CFR 302.

J. **Requirement to Eliminate Illegal Discharges.** Notwithstanding the requirements of subsection (Q) of this section, the Town Engineer/Public Works Director shall require by written notice that a person responsible for an illegal discharge immediately, or by a specified date, discontinue the discharge and, if necessary, take measures to eliminate the source of the discharge to prevent the occurrence of future illegal discharges. Compliance with these requirements shall not relieve the owner/operator of property from which the illegal discharge occurred of any fines, penalties, or liability associated with the action that may be imposed by this section or other applicable laws.

K. **Requirement to Eliminate or Secure Approval for Illicit Connections.**

1. The Town Engineer/Public Works Director shall require by written notice that a person responsible for an illicit connection to the storm drain system comply with the requirements of this section to eliminate or secure approval for the connection by a specified date, regardless of whether or not the connection or discharges to it had been established or approved prior to the effective date of the ordinance codified in this section.

2. If, subsequent to eliminating a connection found to be in violation of this section, the responsible person can demonstrate that an illegal discharge will no longer occur, said person may request Town approval to reconnect. The reconnection or reinstallation of the connection shall be at the responsible person's expense. At the discretion of the Town Engineer/Public Works Director, periodic, random monitoring may be required to ensure compliance with subsection (N) of this section.

L. **Watercourse Protection.** As required by AZPDES Phase II regulations and Chapter 17 of the Oro Valley Town Code, every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property reasonably free of trash, debris, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse. Failure on the part of the property owner to comply may result in liabilities incurred and penalties and fines imposed upon the property owner as defined in this section.

M. **Requirement to Remediate.** Whenever the Town Engineer/Public Works Director finds that a discharge of pollutants is taking place or has occurred which will result in or has resulted in pollution of stormwater, the Town's MS4, or waters of the U.S., the Town Engineer/Public Works Director may convey by written notice to the owner of the property and/or the responsible person the requirement for remediation of the pollution and the restoration of affected property within a specified time pursuant to the provisions of subsections (S), (T), (U),

and (V) of this section. Failure to take prompt remedial action may result in fines, penalties, and liabilities incurred under this section or other applicable laws.

N. **Requirement to Monitor and Analyze.** The Town may in the future be required to adhere to a total maximum daily load (TMDL) or other restriction(s) to a specific pollutant or pollutants established by the State of Arizona or the Federal Government. Should this occur, the Town Engineer/Public Works Director may, by written notice, require that any person engaged in any activity and/or owning or operating any facility which may cause or contribute these specific pollutants in stormwater to undertake at said person's expense such monitoring and analyses and furnish such reports to the Town of Oro Valley as deemed necessary to determine compliance with this section. Additionally, regardless of the restrictions discussed above, the Town Engineer/Public Works Director may, by written notice, require that any person engaged in any activity and/or owning or operating any facility which may cause or contribute to stormwater pollution, illegal discharges, and/or nonstormwater discharges to the storm drain/wash system or waters of the U.S., undertake at said person's expense such monitoring and analyses and furnish such reports to the Town of Oro Valley as deemed necessary to determine compliance with this section.

O. **Notification of Spills.**

1. In the event of a spill or release in reportable quantities as defined in 40 CFR 302, 40 CFR 110, and 40 CFR 117, the person responsible for a facility or operation, or responsible for emergency response for a facility shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release said person shall immediately notify emergency response officials of the occurrence via emergency dispatch services (911). In the event of a release of nonhazardous materials, said person shall notify the Town's Public Works Department in person or by phone or facsimile no later than 5:00 p.m. of the next business day. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also document the type, volume, cause of discharge, corrective actions taken, and remedial actions taken to prevent future occurrences. This information shall be provided to the Town Engineer/Public Works Director in writing within five (5) working days and shall also be retained by the owner/operator for at least three (3) years.

2. Compliance with subsection (O)(1) requirements of this section shall not relieve the discharger from the reporting requirements of 40 CFR 110, 117, and 302.

P. **Maintenance of Stormwater Facilities.**

1. Stormwater facilities shall be maintained per the approved drainage plans or manufacturer's specifications by the owner or other responsible party and shall be repaired and/or replaced by such person when such facilities are no longer functioning as designed.

2. Disposal of waste from maintenance of facilities shall be conducted in accordance with applicable Federal, State and local laws and regulations.

3. Records of installation and maintenance and repair of facilities referenced in subsection (P)(1) of this section shall be retained by the owner or other responsible party for a period of three (3) years and shall be made available to the Public Works Department upon request.

4. Any failure to maintain facilities or correct problems with facilities after receiving due notice from the Town may result in criminal or civil penalties and the Town may perform corrective or maintenance work which shall be at the owner's expense.

Q. **Authority to Inspect.** Whenever necessary to make an inspection to enforce any provision of this section, or whenever the Town Engineer/Public Works Director has cause to believe that there exists, or potentially exists, in or upon any premises any condition which constitutes a violation of this section, the Town Engineer may enter such premises at all reasonable times to inspect the same and to inspect and copy records related to stormwater compliance. When inspections by Town staff reveal deficiencies in the implementation of the SWPPP, a written inspection report will be provided to the owner and operator within fifteen (15) working days of the inspection. In the event the owner or occupant refuses entry after a request to enter and inspect has been made, the Town is hereby empowered to seek assistance from any court of competent jurisdiction in obtaining such entry.

R. **Authority to Sample, Establish Sampling Devices, and Test.** During any inspection as provided herein, the Town Engineer/Public Works Director may take any samples and perform any testing deemed necessary at the expense of the owner/operator of the facility to

aid in the pursuit of the inquiry or to record site activities.

S. **Charges and Penalties.** Charges and penalties levied pursuant to this section shall be collected by the Department of Public Works, Stormwater Utility and utilized for activities in compliance with the Town's MS4 permit. The Town Engineer shall make and enforce efficient management decisions in the maintenance and protection of the Town's storm drainage system.

T. **Operator and/or Owner of Record.** The operator performing on-site activities and/or owner of record of the property upon which a violation of this section occurs shall be presumed to be the person having lawful control over the activity or premises unless it is demonstrated and documented that another person has knowingly and in good faith accepted responsibility for the activity at issue. If more than one (1) person is identified as owner, such persons shall be presumed to be jointly and severally in lawful possession and control of the premises or activity.

U. **Notice to Correct.** The Town may issue a written notice to correct to any person who has violated or is in violation of this section. Failure to comply with actions described in and required by the notice to correct may result in a notice of violation and/or stop work order as described in subsection (V) of this section.

V. **Notice of Violation.**

1. Whenever the Town Engineer/Public Works Director finds that a person has violated a prohibition or failed to meet a requirement in accordance with a notice to correct (subsection (U) of this section), the Town Engineer may order compliance by written notice of violation to the responsible person. The written notice shall state the nature of the violation, the corrective action required, the time frame for the corrective action, and penalties for continued noncompliance. The notice shall be served by either personal service or certified mail to the owner, owner's agent, the operator, the occupant, or the lessee. Such notice may require the violator, without limitation, to:

a. Submit a corrective action plan utilizing best management practices to the authorized representative indicating the cause of the violation, corrective actions to prevent recurrence, and a proposed compliance schedule;

b. Perform monitoring, sampling, laboratory analysis, and reporting of results to the authorized representative and pay costs associated with these activities;

c. Eliminate illicit connections or discharges;

d. Abate and remediate stormwater pollution or contamination hazards, restore affected property, ensure that cleanup has been completed, and make operational changes to prevent future violations;

e. Implement a corrective action plan utilizing source control treatment BMPs to prevent stormwater pollution. Based on site conditions and nature of the contaminant, the authorized representative will determine if the corrective action plan must be prepared, certified and implemented by a qualified person, such as a professional engineer, landscape architect, industrial hygienist registered with the State of Arizona or certified by the American Board of Industrial Hygiene;

f. Stop work on clearing, grading, dredging, excavating, storing, transporting, and/or filling of land, new construction, improvements, alterations, or additions;

g. Maintain, repair, and/or replace existing BMPs;

h. Stop any activity that is in violation of this section;

i. Abate/correct, within time frame specified in notice, any condition that is in violation of this section;

j. Abate immediately any condition in violation of this section that the authorized representative determines to present an immediate threat to public health, safety, or the environment.

2. If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by the Town or a contractor designated by the Town Engineer/Public Works Director and the expense thereof shall be charged to the violator pursuant to subsection (AA) of this section.

3. Failure to comply with any action required by the notice of violation shall be a separate violation for each day beyond the thirtieth calendar day following the notice of violation. Nothing in this section shall limit the authority of the Town to take any action,

including emergency actions or other enforcement action, without first issuing a notice of violation.

W. **Civil Penalties.** In addition to any other enforcement authority contained in this section, the Town may issue a civil citation to any person who has violated, or continues to violate, any provision of this section or any related laws or regulations. A person who is found to have violated any requirement of this section shall be civilly liable to the Town for a sum not to exceed two thousand five hundred dollars ($2,500) per day for each violation.

X. **Criminal Penalties.** A person who willfully or negligently violates any provision of this section shall, upon conviction, be guilty of a class one misdemeanor and may be sentenced to a fine not to exceed two thousand five hundred dollars ($2,500) per day for each violation, imprisonment for a period not to exceed six (6) months and/or probation not to exceed three (3) years.

Y. **Violations Deemed a Public Nuisance.** In addition to the enforcement processes and penalties hereinbefore provided, any condition caused or permitted to exist in violation of any of the provisions of this section is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored by the Town at the violator's expense, and/or the Town may bring a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance.

Z. **Appeal.**

1. Appeals of any determination made by the Town Engineer/Public Works Director relating to a notice of violation issued pursuant to subsection (V) of this section may be made to the Stormwater Utility Commission.

2. Appeals under this section must be filed with the Town Clerk within ten (10) business days from issuance of the notice of violation.

3. Decisions of the Stormwater Utility Commission shall be final unless, within ten (10) days from the date of the Commission's decision, the applicant appeals the decision to the Town Council. An appeal to the Town Council shall be filed in writing with the Town Clerk and scheduled for the next available regular Council meeting.

AA. **Charging Cost of Abatement/Liens.** Within thirty (30) days after abatement of the nuisance by the Town, the Town Engineer/Public Works Director shall notify the property owner of the cost of abatement plus twenty percent (20%) to cover administrative costs. If the amount due is not paid within sixty (60) days of the notification to pay, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment. A copy of the resolution shall be turned over to the County Assessor so that the Assessor may enter the amounts of the assessment against the parcel as it appears on the current assessment roll, and the Assessor shall include the amount of the assessment on the bill for taxes levied against the parcel of land.

BB. **Urgency Abatement.** The Town Engineer/Public Works Director is authorized to require immediate abatement of any violation of this section that constitutes an immediate threat to the health, safety or well-being of the public. If any such violation is not abated immediately as directed by the Town Engineer/Public Works Director, the Town is authorized to enter onto private property and to take any and all measures required to remediate the violation. Any expense related to such remediation undertaken by the Town shall be fully reimbursed by the property owner and/or responsible party. Any relief obtained under this section shall not prevent the Town from seeking other and further relief authorized under this section.

CC. **Penalties and Corrective Actions.**

1. It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this section. The remedies provided in this subsection are cumulative and the Town may seek one (1) or more such remedies as described in subsections (V), (W), (X), and (Y) of this section.

2. Any person violating this section shall be liable to the Town for all damages, costs, fines, and penalties incurred by the Town.

3. Upon finding that any person has violated this section, the Court may issue an order or, in the case of a criminal conviction, terms of probation, requiring the violator to perform any of the remediation activities listed in subsection (V) of this section.

4. If more than one person is identified as the owner of record, all persons will be presumed to be jointly and severally in lawful possession and control of the property and/or

activity. The transfer of ownership, possession, or control of real property to another person does not relieve the transferor of the responsibility for violations of this title that occurred before the transfer.
((O)08-20, Amended, 10/01/08; (O)08-15, Added, 09/03/08)

Compile Chapter
