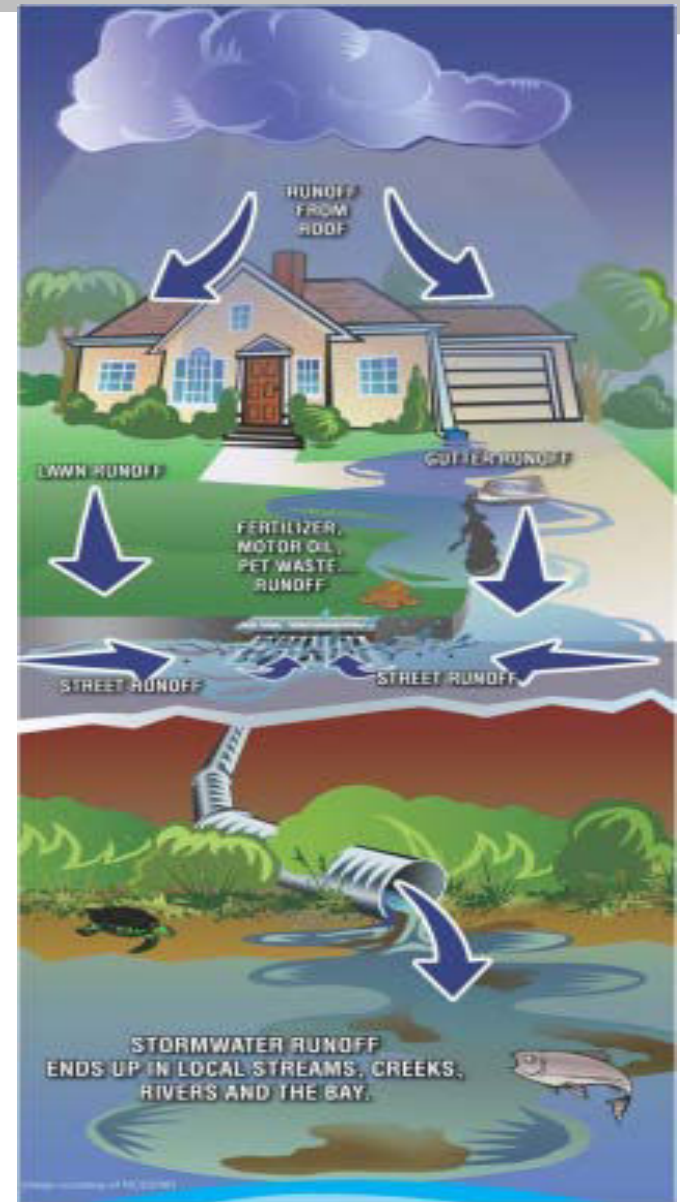


DRAINAGE BASICS



DRAINAGE BASICS

- **Common Terminology & Reference Tools**
- **Drainage Components**
- **Determine Existing Conditions**
- **Calculate Development Requirements**

DRAINAGE BASICS

Common Terminology & Useful Tools

CFS= Cubic Feet per Second- cross-section of drainage structure x velocity

100 year storm- generally assumed to be an event with a 1% chance of happening in any given year, or an event that is expected to occur, "on average," once every 100 years. Typically rain events are defined in terms of both "frequency" (100-year, 50-year, 5-year, etc.) and "duration" (1-hour, 6-hours, 1-day, 3-days, etc.).

Historic Outfall-Location where a property naturally drains

Contributing Surface Area- the total area flowing to an outlet produces contributing volume

Retention Volume-100-year, 2-hour rainfall depth in inches x drainage area x soil porosity factor

DRAINAGE BASICS

Common Terminology & Useful Tools

CLOMR-Conditional Letter of Map Revision provides approval of design but not full approval.

LOMR-Letter of Map Revision-approves construction of the designed facilities and then amends the FEMA flood maps to reflect that the property is no longer in a flood plain

NOAA- National Oceanic and Atmospheric Administration

DRAINAGE BASICS

Common Terminology & Useful Tools

<u>Street Type</u>	<u>Design Storm</u>	<u>Maximum Flow</u>	<u>Maximum Velocity</u>	<u>Required Dry Lanes</u>	<u>Maximum Depth of Water</u>
<u>Arterial</u> & <u>Collector</u>	<u>10 year</u>	100 cfs	10 ft/sec	Flood only one lane of traffic per half street	To top of curb;
	<u>100 year</u>	100 cfs	10 ft/sec	None	6" above top of curb; flow contained in ROW
<u>Local Road</u>	<u>10 year</u>	100 cfs	10 ft/sec	None	To top of curb
	<u>100 year</u>	100 cfs	10 ft/sec	None	6" above top of curb; flow contained in ROW

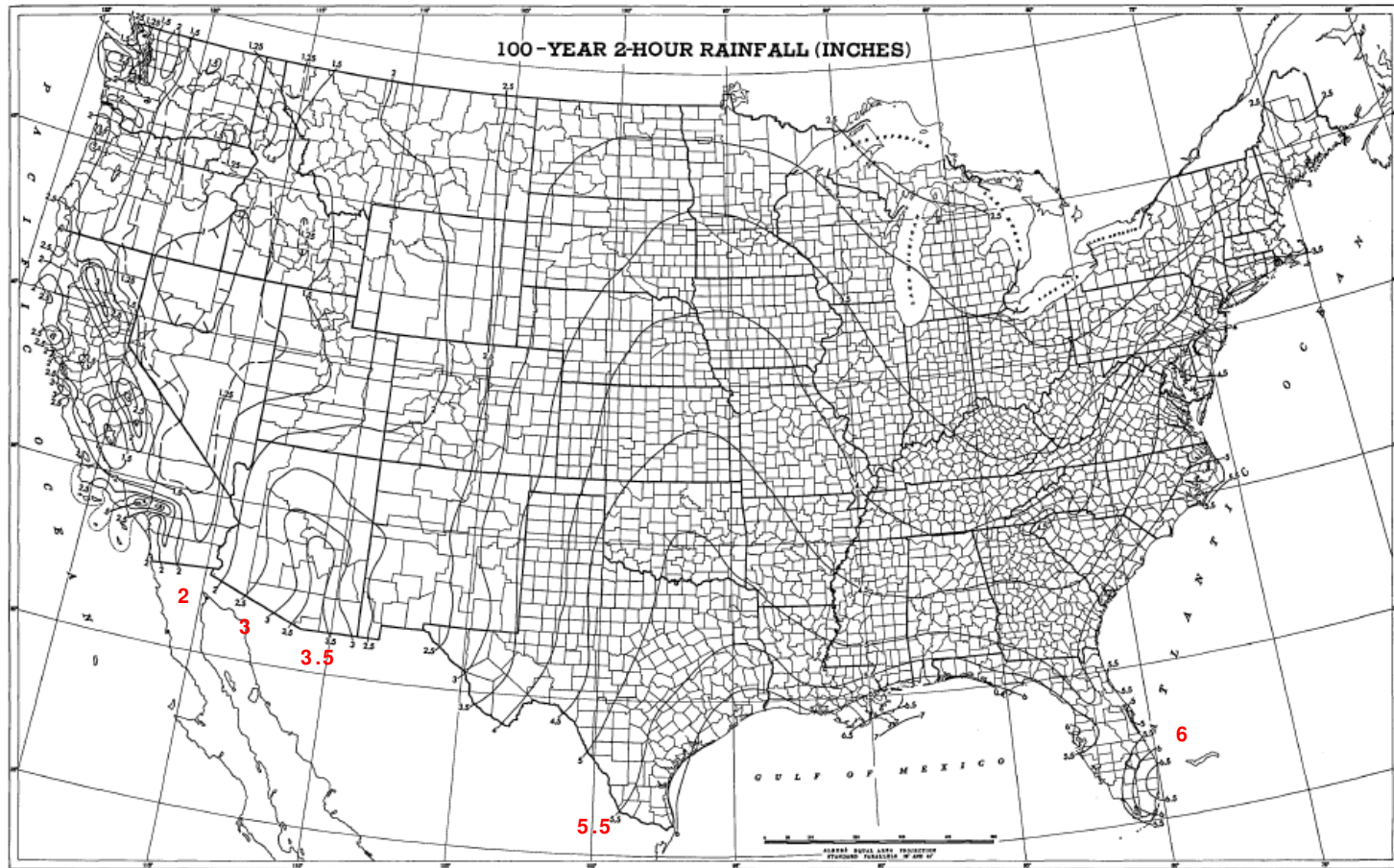
Example of 10 year storm event with exterior lane flooded while interior lane is dry



Example of 10-100 year storm event with water flowing over curb and all lanes partially covered

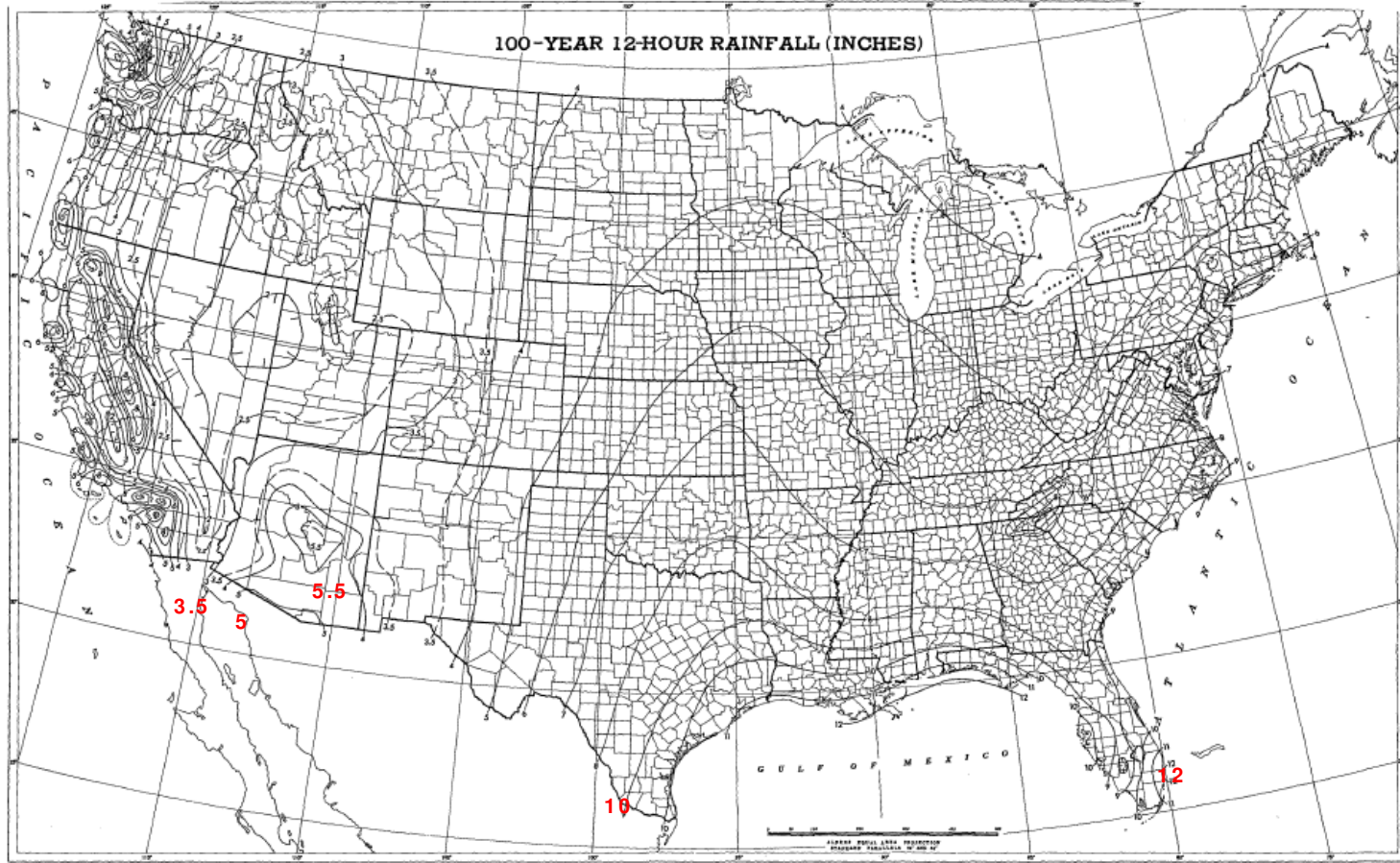
DRAINAGE BASICS

NOAA 100 year-2 hour rainfall map



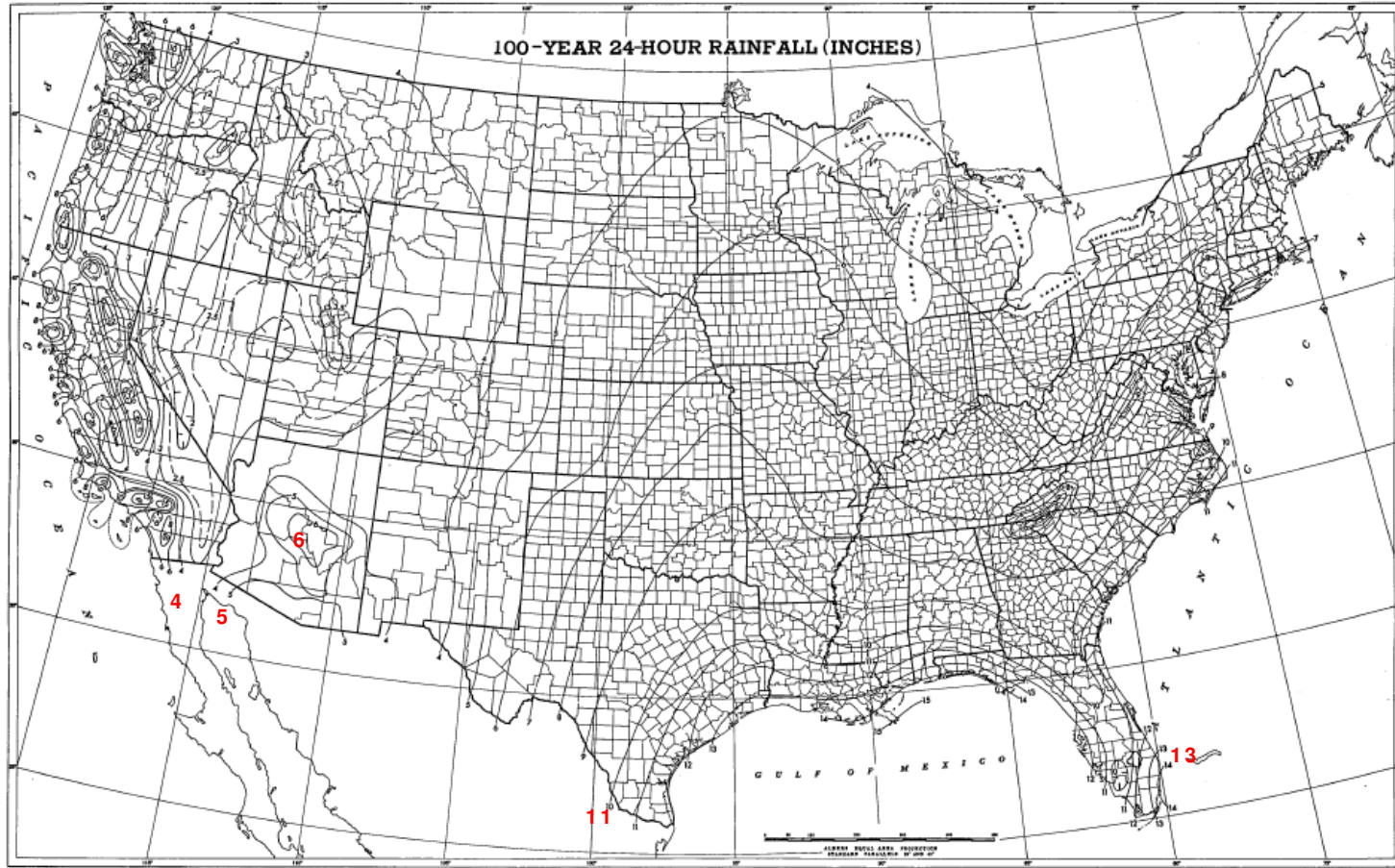
DRAINAGE BASICS

NOAA 100 year-12 hour rainfall map



DRAINAGE BASICS

NOAA 100 year-24 hour rainfall map



DRAINAGE BASICS

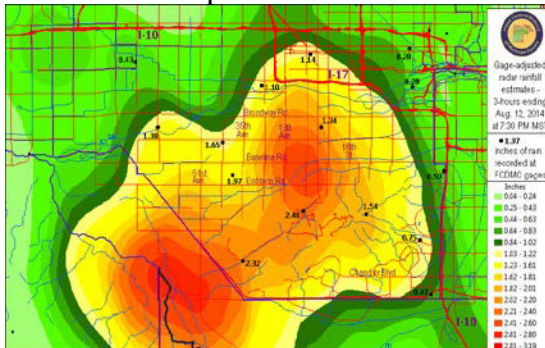
100 year storm?

Data Statistics for Period of Record:

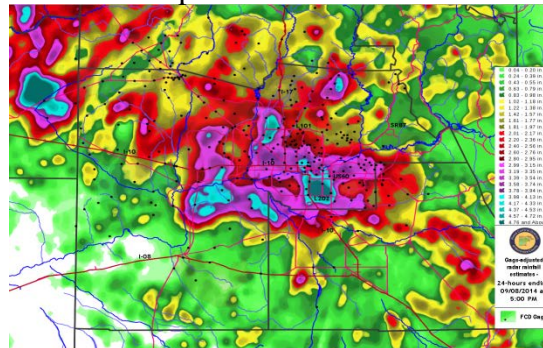
Maricopa County
Rain Gauge #6525

Number of storms greater than 1 inch in 24 hours:	30	
Number of storms greater than 2 inches in 24 hours:	2	
Number of storms greater than 3 inches in 24 hours:	1	
		Approx. T_r
Greatest 15 minute total:	1.16" on 08/12/14	81 years
Greatest 1 hour total:	2.35" on 08/12/14	285 years
Greatest 3 hour total:	2.61" on 09/08/14	165 years
Greatest 6 hour total:	4.07" on 09/08/14	1,000 years
Greatest 24 hour total:	4.20" on 09/08/14	270 years
Greatest 72 hour total:	4.20" on 09/08/14	85 years

Rainfall map 8/12/2014



Rainfall map 9/08/2014



DRAINAGE BASICS

DRAINAGE COMPONENTS

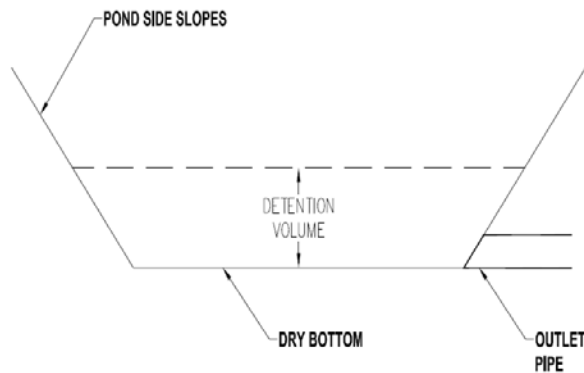
- **Storm water storage-Detention/retention basins, spreader basins & underground storage**
- **Drainage conveyance-Storm drain pipe, drainage inlets, drainage outlets, channels & drywells**
- **Existing drainage channels, washes**

DRAINAGE BASICS

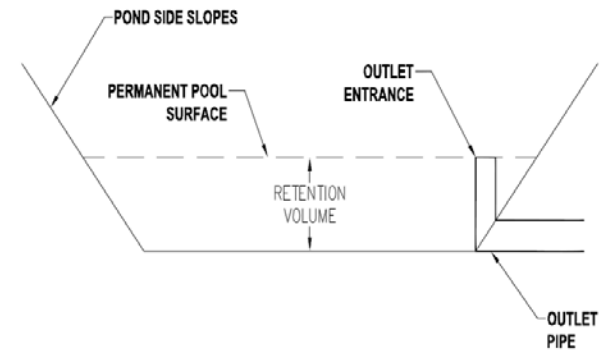
TYPICAL DRAINAGE COMPONENTS

Storm Water Storage

- **Basins-Detention vs. Retention-**A detention, or dry, pond has a bleed-off at the bottom of the basin and does not have a permanent pool of water. All the water runs out between storms and it usually remains dry. A retention basin or pond has a riser and bleed-off at a higher point and retains water.



DETENTION POND DIAGRAM



RETENTION POND DIAGRAM

DRAINAGE BASICS

TYPICAL DRAINAGE COMPONENTS

Spreader Basin-Used to reduce concentrated drainage flows



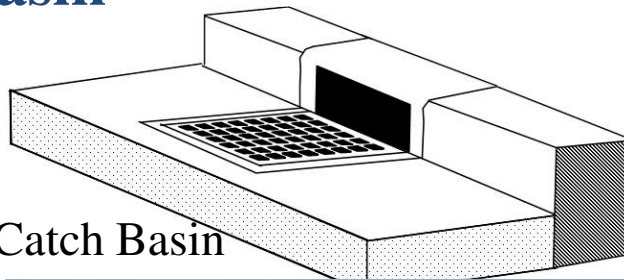
Underground storage- used in areas with limited area for retention or detention basins



DRAINAGE BASICS

TYPICAL DRAINAGE COMPONENTS

Conveyance-Inlet structures can include catch basins, scuppers, drop inlets and are either connected to storm drain pipes or drain directly into the drainage structure or basin



Catch Basin



Drop Inlet



Scupper



DRAINAGE BASICS

TYPICAL DRAINAGE COMPONENTS

**Conveyance-storm
drain pipe for
smaller flow**



Diameter, Inch	Area, Sq. Ft.	Minimum Slope	Approximate CFS rating
18	1.767	0.0026	5.30
24	3.142	0.0017	9.43
30	4.909	0.0013	14.73
36	7.069	0.0010	21.21
42	9.621	0.00082	28.86
48	12.566	0.00069	37.70
54	15.904	0.00059	47.71
60	19.635	0.00051	58.90
66	23.758	0.00045	71.27
72	28.274	0.00040	84.22
84	38.484	0.00033	115.4
96	50.266	0.00027	150.8

DRAINAGE BASICS

TYPICAL DRAINAGE COMPONENTS

**Conveyance-Box
culverts, bridges
and channels used
for larger flows**



DRAINAGE BASICS

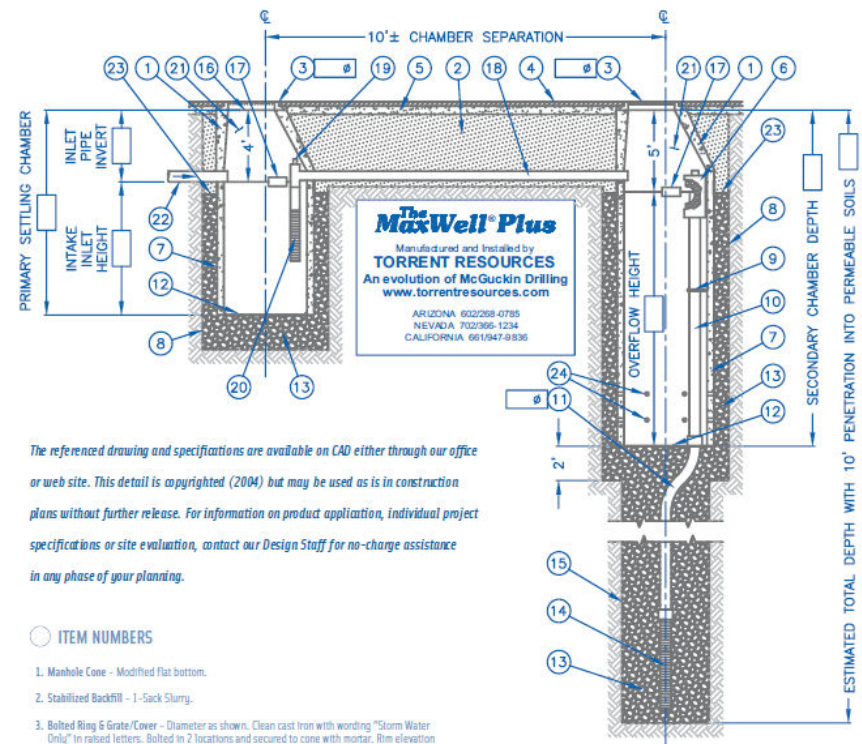
TYPICAL DRAINAGE COMPONENTS

Drywells-drain surface water into permeable soil below

Conveyance-Outlet structures are typically headwalls that drain into a basin or channel



The MaxWell® Plus Drainage System Detail And Specifications



The referenced drawing and specifications are available on CAD either through our office or web site. This detail is copyrighted (2004) but may be used as is in construction plans without further release. For information on product application, individual project specifications or site evaluation, contact our Design Staff for no-charge assistance in any phase of your planning.

ITEM NUMBERS

1. Manhole Cone - Modified Flat bottom.
2. Stabilized Backfill - 1-Sack Slurry.
3. Bolted Ring & Grate/Cover - Diameter as shown. Clean cast iron with wording "Storm Water Only" in raised letters. Bolted in 2 locations and secured to cone with mortar. Rim elevation $\pm 0.02'$ of plans.
4. Graded Basin or Paving (by Others).
5. Compacted Base Material (by Others).

AZ L.E. 100227948 A, 100204787 B-4, AZ011301
CA L.E. 520395, C-42, 1042,
NV L.E. 0103330 A - NW L.E. 100204 0104

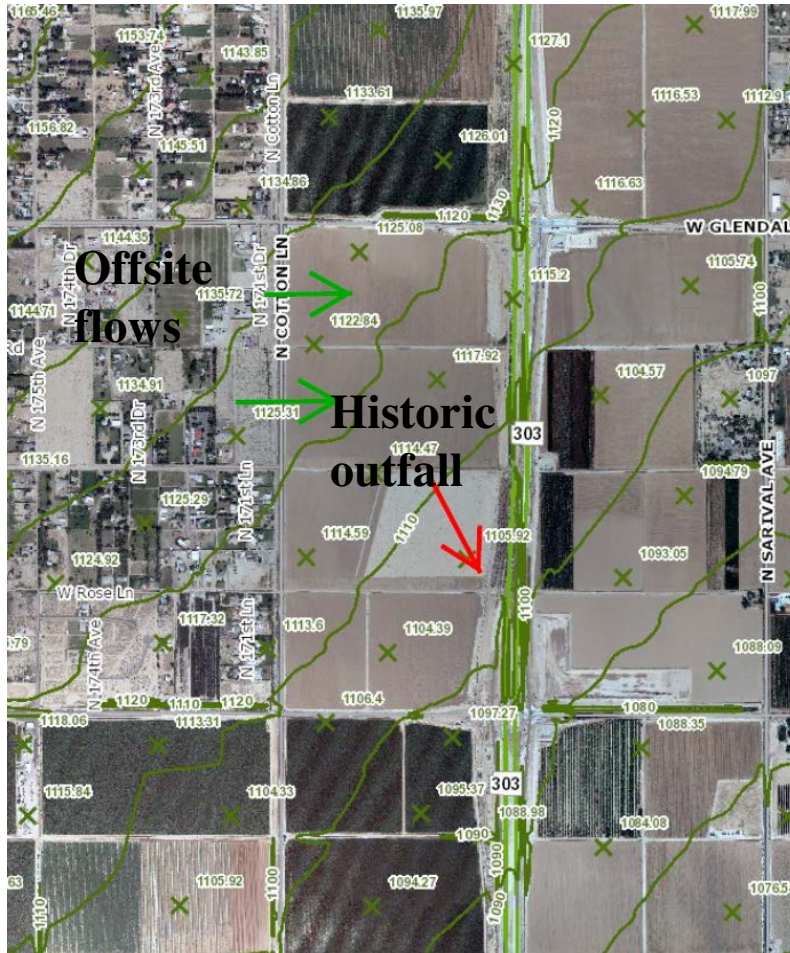
DRAINAGE BASICS

EXISTING CONDITIONS

- **Historic drainage outfall**
- **Contributing surface area-adjacent properties draining into or through your property**
- **Protected waters or washes (404 conditions)**
- **Flood conditions**

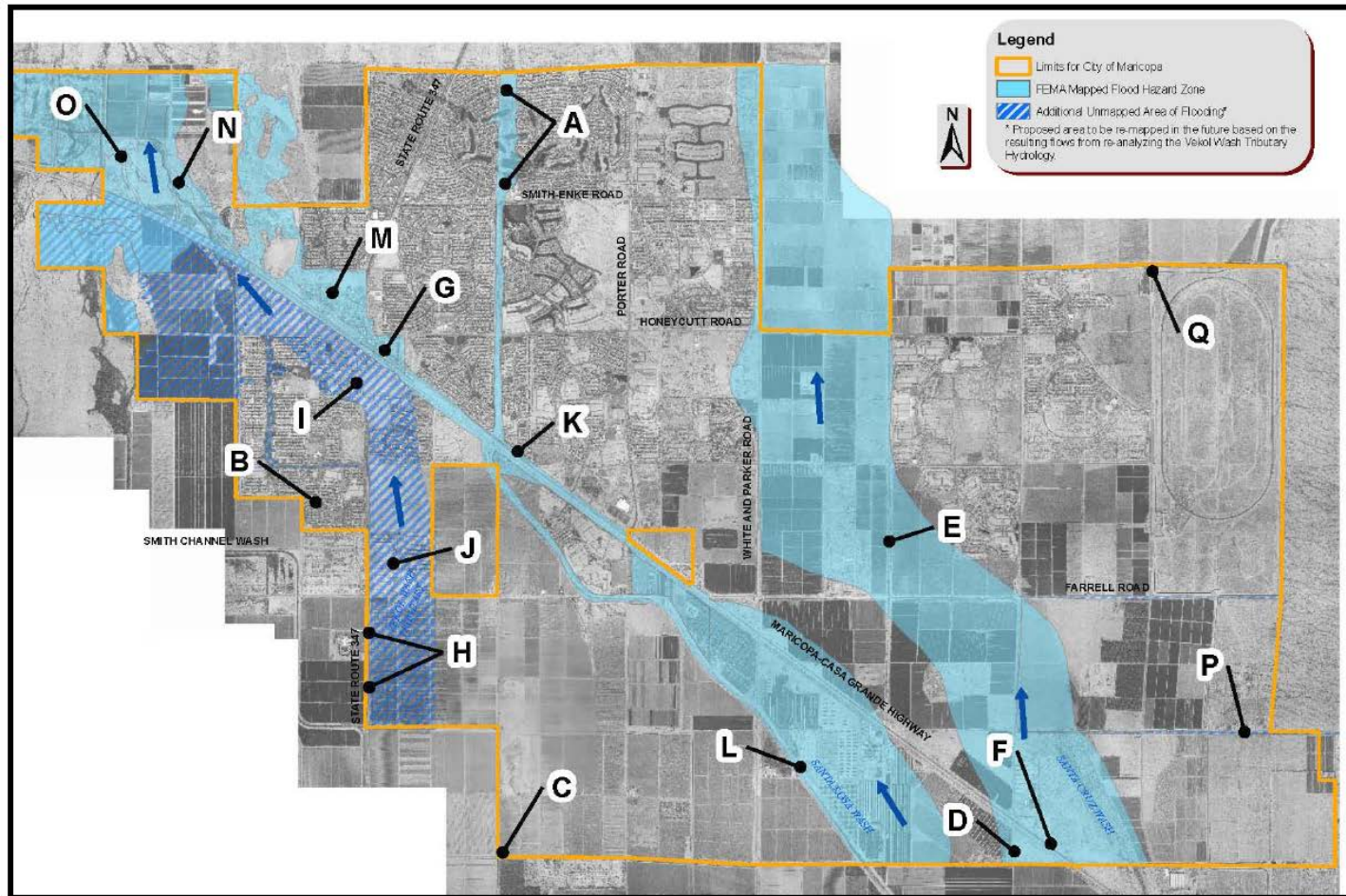
DRAINAGE BASICS

Grade Contour & FEMA Flood Control Maps



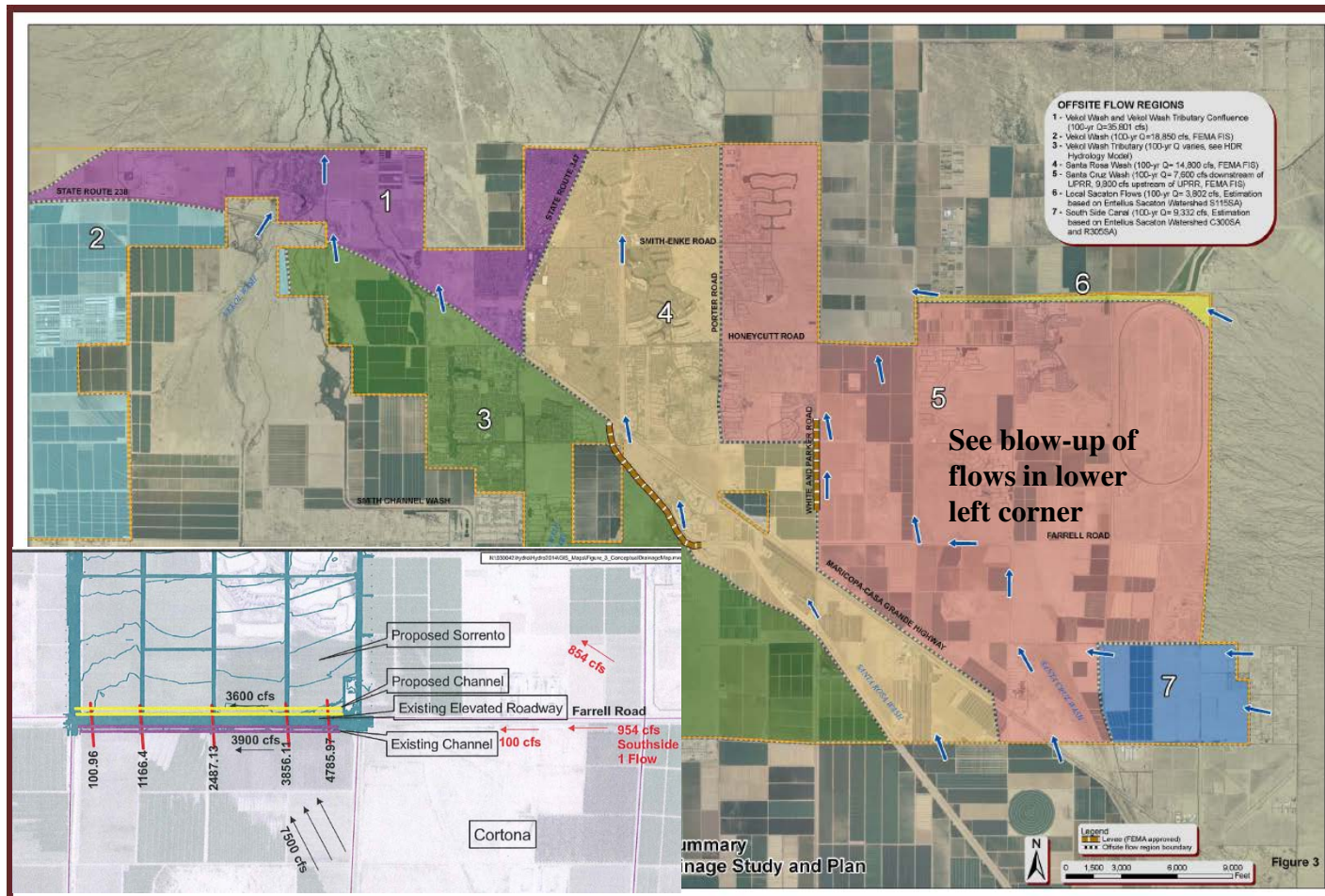
DRAINAGE BASICS

Grade Contour & FEMA Flood Control Maps



DRAINAGE BASICS

Grade Contour & FEMA Flood Control Maps



DRAINAGE BASICS

Design Requirements

- **Allow for 5-10% minimum of total site size for drainage facilities**
- **Facilitate offsite flow via drainage channel, pipe or wash**
- **Protected waters or washes-Verify and then apply/process 404 permits thru Army Corp of Engineers**
- **Flood conditions-If the property lies in a flood plain need to design and elevate/protect facilities through a CLOMR/LOMR process**

DRAINAGE BASICS

Falcon View II

