2019 Storm Drainage Master Plan

Land Use, Transportation & Infrastructure Committee (LUTI)

October 15, 2019

Bruce Uhernik – Public Works, Storm Drainage Planning

Don Jacobs – Enginuity Engineering

Resolution 19-1007

CITY & COUNTY OF DENVER
STORM DRAINAGE MASTER PLAN

A Resolution approving the adoption of the October 2019 update to the City and County of Denver Storm Drainage Master Plan as the official master drainage plan of the City and County of Denver.

June 2015 – Upper Montclair

July 2018 – Montbello

Authorization

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D.R.M.C. Sec 56-110

- Requires City Council adoption every 5 years

1989

2005

2009

2014

2019

Intent

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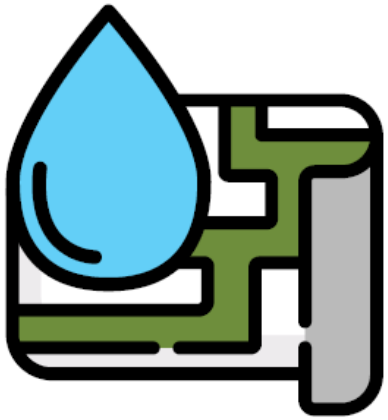

INVENTORY EXISTING SYSTEMS

EVALUATE CITYWIDE FLOOD RISK

DEVELOP INITIAL SYSTEM RECOMMENDATIONS

Storm Planning

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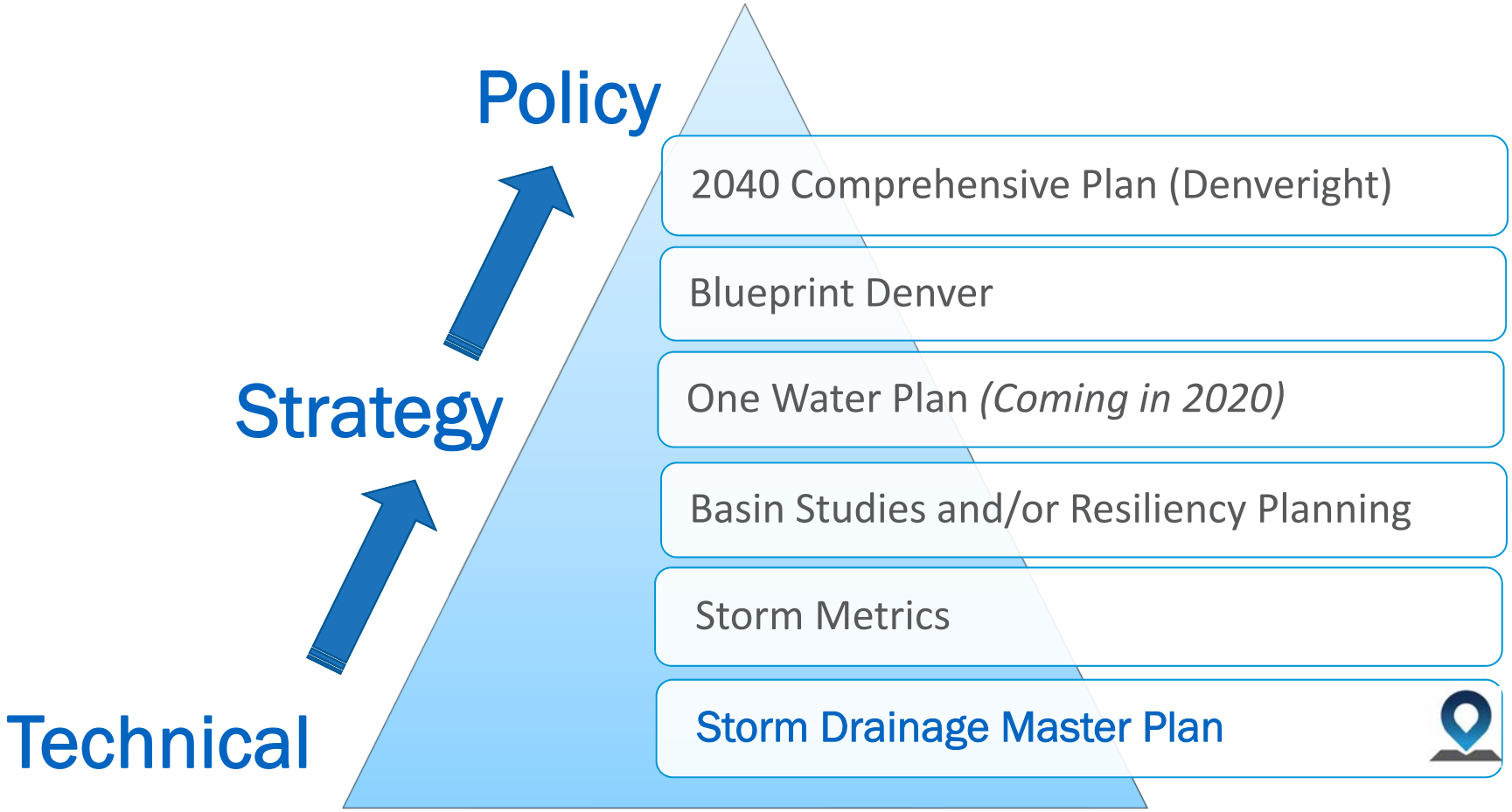

Who Uses the Master Plan?

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2014

- Public Works
  - Capital Projects
  - Street Maintenance
  - Development Services
- Developers and Engineers
- Council Offices and constituents

Goals with New Update

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2014

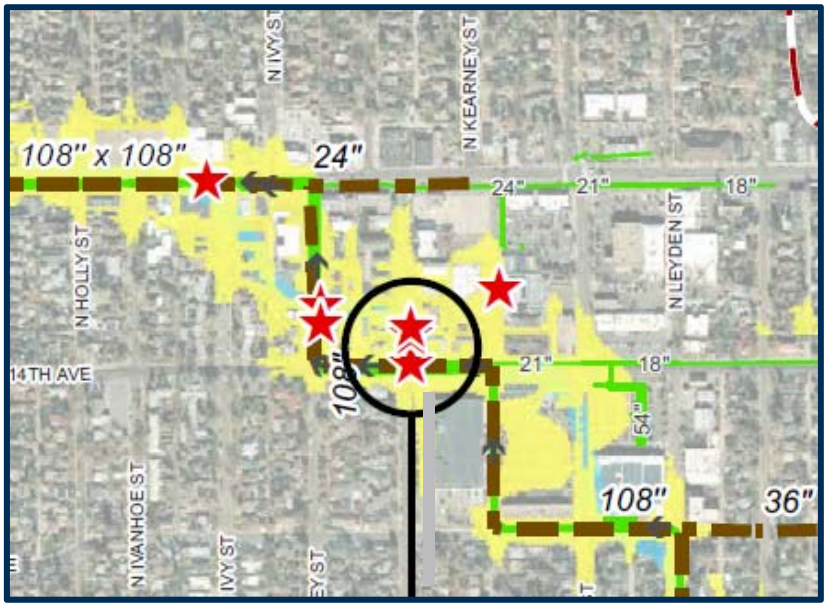
- ✓Reported Flooding Locations
- ✓Surface Inundation Areas
- ✓Mile High Flood District Recommendations

2019

1. **Technically Up-To-Date** *(RELIABILITY)*
2. **Increase Usage** *(ACCESSIBILITY)*
3. **User Friendliness** *(CLARITY)*
4. **More Functional** *(UTILITY)*

Goal #1: Reliability

- ✓ Updated Models
- ✓ Latest Information & Standards
- ✓ Consistent with Criteria



Goal #2: Accessibility

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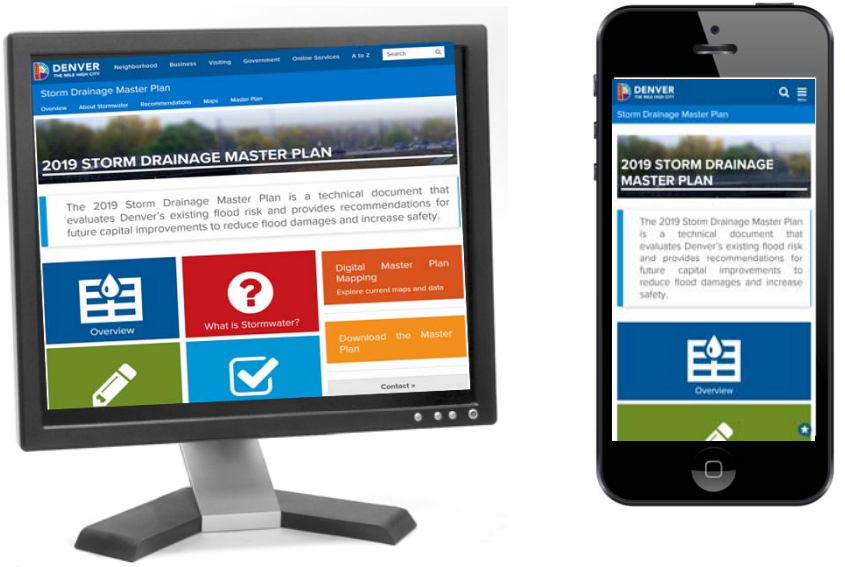
- ✓ Digital platform - denvergov.org/stormwater
- ✓ ADA Compliance
- ✓ Improved PDF

OLD



NEW

Goal #3: Clarity

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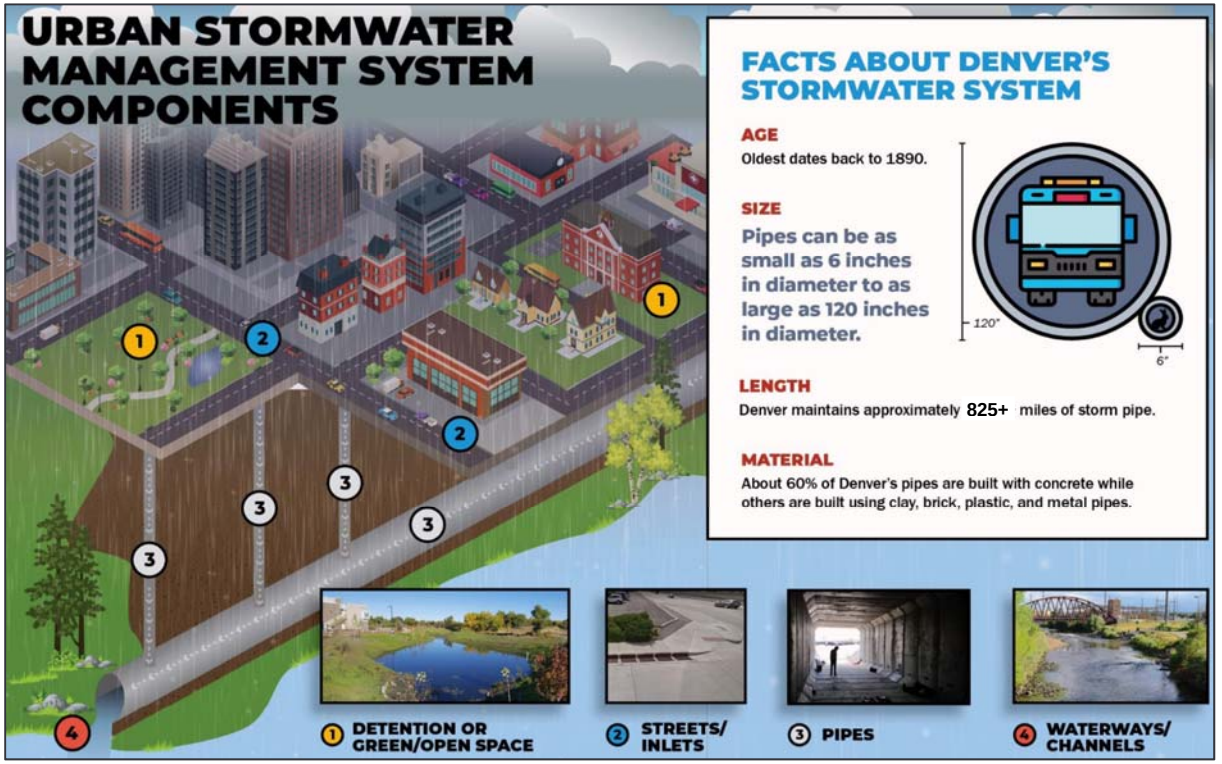
- ✓ Understood by all audiences
- ✓ New educational materials
- ✓ Links to resources

Maps

2019 SDMP Educational Story Map

Flood Risk Identification Map

2019 SDMP Recommendations Map



Goal #4: Utility *(Functionality)*

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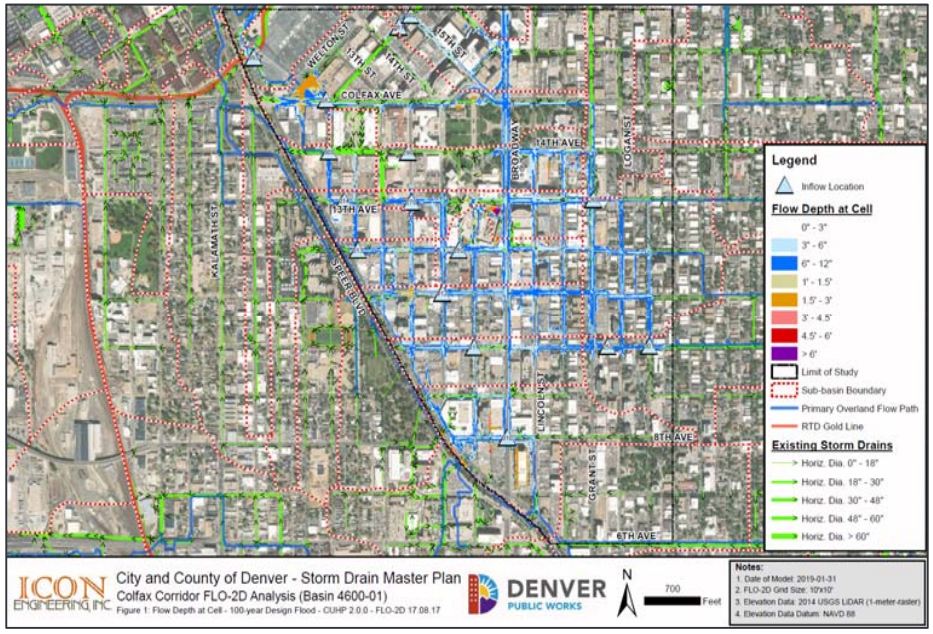
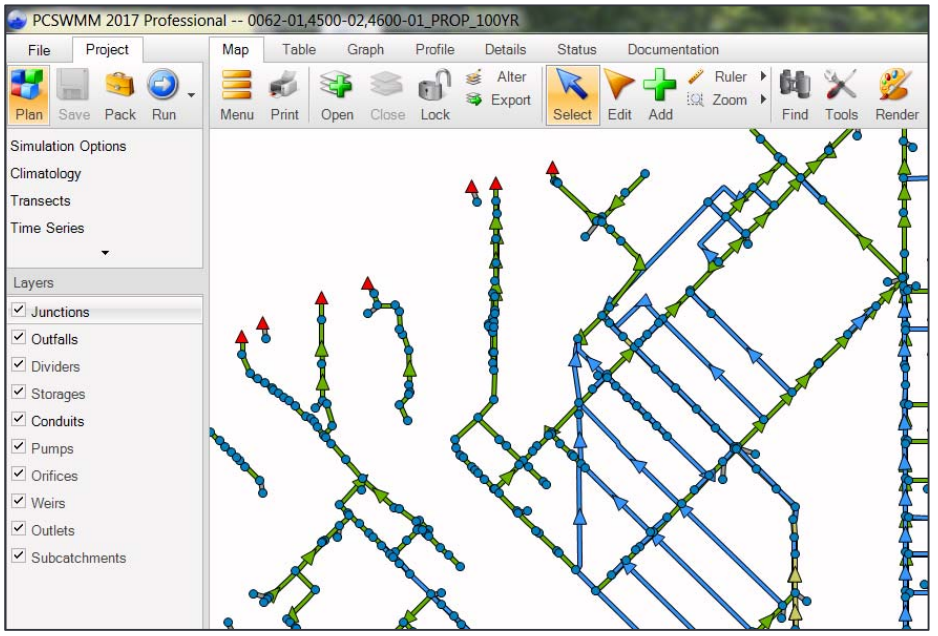
- ✓ Higher accuracy and more precise models
- ✓ Jump-start design
- ✓ Save time & money





Results

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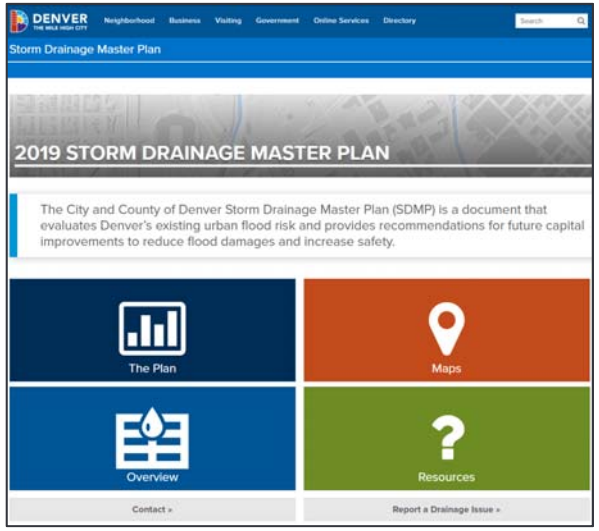

Website

https://www.denvergov.org/stormwater

Story Map

https://geospatialdenver.maps.arcgis.com/apps/Cascade/index.html?appid=0d799837c6e14a0a80857858dce9f474

Recommendations Map

https://geospatialdenver.maps.arcgis.com/apps/webappviewer/index.html?id=7146d79e12a64aeabc204173be1327d1

11x17 Report

Report download link pending

Demonstration

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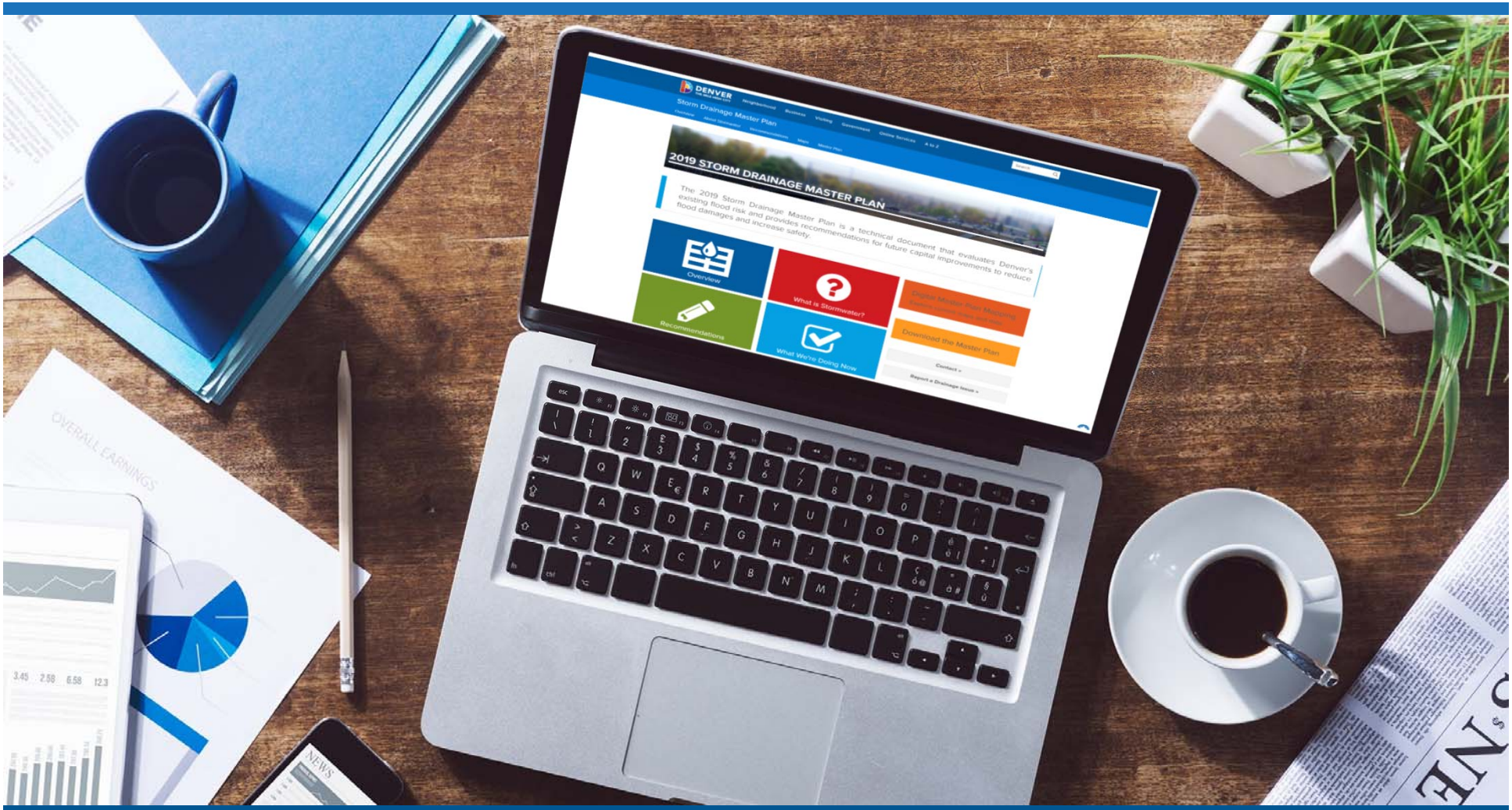

Report Document

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Old

Denver Storm Drainage Master Plan — September 2014

August 2-3, 1951 - Almost 3½ inches of rain fell on the Denver Metro area.

July 9, 1953 - Heavy rains caused estimated 2 million dollars damage from flooded stores and basements across metro Denver. The floodwaters reached a depth of 3 feet on streets in some sections of the City, damaging streets and automobiles. The heavy rainfall at Lowry Air Force Base totaled 3.9 inches.

July 30-August 3, 1956 - Up to 12-inches of rain fell in five days in the Denver area and on the western slope, causing $5 million in damage.

June 16, 1965 - Black Wednesday, the day Denver was hit by the worst natural disaster in the City's history. After a cloudburst that dumped 15 inches of water on mountain slopes southwest of Denver, a devastating flood struck 20 counties, including Denver along the South Platte River. Twenty-five people were killed, and property damage was estimated at more than $500 million. Since that time, Chatfield and Bear Creek Dams have been constructed greatly reducing the flood threat to Denver from precipitation over major sub-drainage basins.

July 23, 1965 - Heavy rains in Aurora washed out earthen bridges over Sand Creek. Several highways were washed out to the east and southeast of Denver.

July 24, 1965 - Heavy rain fell over all of the Denver and Aurora areas, causing some flooding of roads, streets, and bridges.

July 7, 1967 - A storm caused flood damage in southwest and south Denver. Unofficial reports indicated rainfall of 2 inches in 30 minutes and more than 3 inches total from the storm. Streets and buildings were flooded by the heavy runoff. Hail in some areas contributed to flooding by blocking storm drains. Water reached a depth of 5 feet in the street. Police rescued numerous stranded motorists. In southwest metro Denver, 100 to 150 homes were flooded, and there was one fatality.

May 4-12, 1969 - Heavy rains caused flooding on the South Platte River in Denver.

June 8, 1969 - Heavy rain flooded streets and underpasses throughout metro Denver. The heaviest amounts of rain fell in south Denver and Englewood, where unofficial totals of 5 to 6 inches were reported. Mud, debris, and hail carried by the heavy runoff clogged drains and increased the amount of flooding. Approximately 40 cars and a large truck were inundated at an underpass on I-25, and several more were inundated or buried in mud in other areas. A large number of basements were flooded and streets and highways were heavily damaged in some areas.

June 11, 1970 - Over 3 inches of heavy rain flooded streets and underpasses throughout metro Denver.

May 5-18, 1973 - Prolonged rains of up to 6 inches on May 5th and 6th in the South Platte Basin, along with melting of a large snow pack, produced major flooding during the next two weeks along Clear Creek, Sand Creek, and the South Platte River in the Denver metro area. One person died and damages were estimated at around 120 million dollars.

July 20, 1975 - Heavy rains caused flash flooding across metro Denver, resulting in the closing of several streets and damage to numerous homes and businesses.

June 13, 1984 - One of the worst hailstorms eve… rains with as much as 4.75 inches in Lakewood … flooding. There was one fatality.

May 16-17, 1995 - Significant moisture and ups… Moderate to heavy rains which began on the eve… spread eastward over metro Denver throughout t… Colorado Water Conservation Board (CWCB) a… reported 15 flood-related deaths statewide and d…

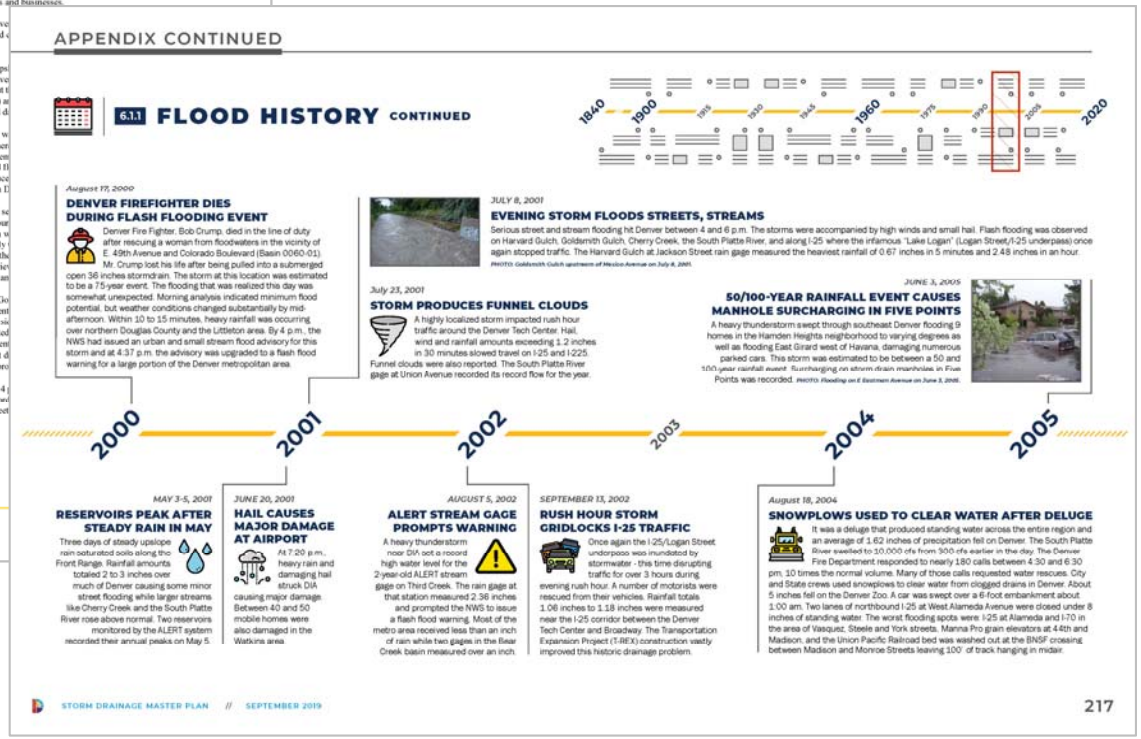
June 4, 1995 - The heaviest measured rainfall w… Country Club located in southwest Denver wher… Residential flooding and storm drainage problem… to Bear Creek. The June 4th storm also caused fl… and Sheridan. This single thunderstorm produce… Bear Creek and the South Platte River through D…

July 19, 1997 - At approximately 4:00 p.m., a s… produced 3.83 inches of rain in less than an hour… 2.2 inches set on August 13, 1921. This storm w… stone diameters reaching 1.25 inches. Westerly … Stapleton International Airport property from th… overtopped Montview Boulevard. The Montvie… flood, a project completed by Denver, Aurora an…

July 27, 1997 - Between 3:00 and 4:00 p.m., Go… with 1.66 inches falling at the Denver Tech Cent… 10-year levels causing the recently completed si… function. This flood control facility, constructed… preventing damages downstream. Local residen… glitch did occur, however, when the pump that d… Management Division officials corrected the pro…

The Eastman Avenue ALERT gage peaked at 4… discharge of 1,670 cfs, exceeding its prior record… the DTC had a maximum water depth of 8.2 feet…

New



APPENDIX CONTINUED

6.1.1 FLOOD HISTORY CONTINUED

1840 1900 1915 1930 1945 1960 1975 1990 2005 2020

August 17, 2000
DENVER FIREFIGHTER DIES DURING FLASH FLOODING EVENT
Denver Fire Fighter, Bob Crump, died in the line of duty after rescuing a woman from floodwaters in the vicinity of E. 49th Avenue and Colorado Boulevard (Basin 0060-01). Mr. Crump lost his life after being pulled into a submerged open 36 inches stormdrain. The storm at this location was estimated to be a 75-year event. The flooding that was realized this day was somewhat unexpected. Morning analysis indicated minimum flood potential, but weather conditions changed substantially by mid-afternoon. Within 10 to 15 minutes, heavy rainfall was occurring over northern Douglas County and the Littleton area. By 4 p.m., the NWS had issued an urban and small stream flood advisory for this storm and at 4:37 p.m. the advisory was upgraded to a flash flood warning for a large portion of the Denver metropolitan area.

JULY 8, 2001
EVENING STORM FLOODS STREETS, STREAMS
Serious street and stream flooding hit Denver between 4 and 6 p.m. The storms were accompanied by high winds and small hail. Flash flooding was observed on Harvard Gulch, Goldsmith Gulch, Cherry Creek, the South Platte River, and along I-25 where the infamous "Lake Logan" (Logan Street/I-25 underpass) once again stopped traffic. The Harvard Gulch at Jackson Street rain gage measured the heaviest rainfall of 0.67 inches in 5 minutes and 2.48 inches in an hour.
PHOTO: Goldsmith Gulch upstream of Mexico Avenue on July 8, 2001.

July 23, 2001
STORM PRODUCES FUNNEL CLOUDS
A highly localized storm impacted rush hour traffic around the Denver Tech Center. Hail, wind and rainfall amounts exceeding 1.2 inches in 30 minutes slowed travel on I-25 and I-225. Funnel clouds were also reported. The South Platte River gage at Union Avenue recorded its record flow for the year.

JUNE 3, 2005
50/100-YEAR RAINFALL EVENT CAUSES MANHOLE SURCHARGING IN FIVE POINTS
A heavy thunderstorm swept through southeast Denver flooding 9 homes in the Hamden Heights neighborhood to varying degrees as well as flooding East Girard west of Havana, damaging numerous parked cars. This storm was estimated to be between a 50 and 100-year rainfall event. Surcharging on storm drain manholes in Five Points was recorded.
PHOTO: Flooding on E Eastman Avenue on June 3, 2005.

2000 2001 2002 2003 2004 2005

MAY 3-5, 2001
RESERVOIRS PEAK AFTER STEADY RAIN IN MAY
Three days of steady upslope rain saturated soils along the Front Range. Rainfall amounts totaled 2 to 3 inches over much of Denver causing some minor street flooding while larger streams like Cherry Creek and the South Platte River rose above normal. Two reservoirs monitored by the ALERT system recorded their annual peaks on May 5.

JUNE 20, 2001
HAIL CAUSES MAJOR DAMAGE AT AIRPORT
At 7:20 p.m., heavy rain and damaging hail struck DIA causing major damage. Between 40 and 50 mobile homes were also damaged in the Watkins area.

AUGUST 5, 2002
ALERT STREAM GAGE PROMPTS WARNING
A heavy thunderstorm near DIA set a record high water level for the 2-year-old ALERT stream gage on Third Creek. The rain gage at that station measured 2.36 inches and prompted the NWS to issue a flash flood warning. Most of the metro area received less than an inch of rain while two gages in the Bear Creek basin measured over an inch.

SEPTEMBER 13, 2002
RUSH HOUR STORM GRIDLOCKS I-25 TRAFFIC
Once again the I-25/Logan Street underpass was inundated by stormwater - this time disrupting traffic for over 3 hours during evening rush hour. A number of motorists were rescued from their vehicles. Rainfall totals 1.06 inches to 1.18 inches were measured near the I-25 corridor between the Denver Tech Center and Broadway. The Transportation Expansion Project (T-REX) construction vastly improved this historic drainage problem.

August 18, 2004
SNOWPLOWS USED TO CLEAR WATER AFTER DELUGE
It was a deluge that produced standing water across the entire region and an average of 1.62 inches of precipitation fell on Denver. The South Platte River swelled to 10,000 cfs from 300 cfs earlier in the day. The Denver Fire Department responded to nearly 180 calls between 4:30 and 6:30 pm. 10 times the normal volume. Many of those calls requested water rescues. City and State crews used snowplows to clear water from clogged drains in Denver. About 5 inches fell on the Denver Zoo. A car was swept over a 6-foot embankment about 1:00 am. Two lanes of northbound I-25 at West Alameda Avenue were closed under 8 inches of standing water. The worst flooding spots were I-25 at Alameda and I-70 in the area of Vasquez, Steele and York streets. Manna Pro grain elevators at 44th and Madison, and the Union Pacific Railroad bed was washed out at the BNSF crossing between Madison and Monroe Streets leaving 100' of track hanging in midair.

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Hydraulic Model

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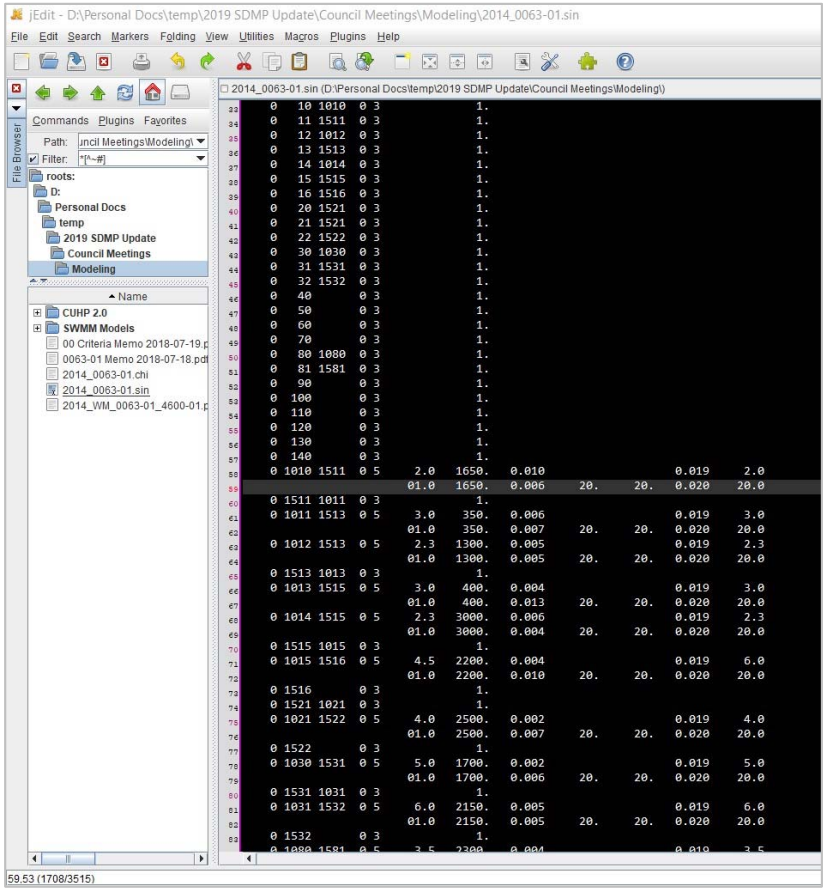
Old



New