

SALT CREEK FLOODPLAIN RESILIENCY STUDY FAQs

What is the schedule of the study?

The study is scheduled to be completed by the end of April 2020.

Does the study include updated floodplain maps?

No. A regulatory floodplain map update was not included in the scope. The Salt Creek floodplains were remapped in 2005.

Does this study have a role with the Lincoln-Lancaster County comprehensive plan like suggesting different standards with building materials?

The study will make recommendations on regulations, policy, and flood reduction measures. These recommendations may be incorporated in a general manner into future Lincoln- Lancaster Comprehensive Plan. One example may be low impact development regulations.

Is the foundation for the study based on climate change?

The purpose of study is to develop recommendations to reduce adverse impacts from flooding to life and property, based on current and future flood events. The study includes review of national floodplain best management practices and the potential impacts of a warming climate. Recommended flood control measures will be evaluated using current and future flood events.

How is a flood event defined?

- 2 year event = 50% annual chance of occurrence
- 10 year event = 10% annual chance of occurrence
- 50 year event = 2% annual chance of occurrence
- 100 year event = 1% annual chance of occurrence
- 500 year event = .2% annual chance of occurrence

What event is used for floodplain management regulations?

The 1 percent annual chance flood event is the federal, state and local regulatory flood for floodplain mapping and administration purposes.

What are other folks “skin in the game,” those not in the floodplain?

Large flood events can have devastating, community-wide impacts that go far beyond the impacts to those who were flooded. Economic damages can be a massive burden for a community, particularly one trying to recover from a flood event. Businesses can be disrupted throughout the community because of loss of rail, vehicle, or air services. Loss of power, water supply, or sanitary sewer services can impact the entire community. Loss of tax revenues can lead to budget shortfalls and disruption of future services and infrastructure investment.

Does the pace of development impact the floodplain?

The City of Lincoln adopted detention standards city-wide in the late 1990s, a No Adverse Impact (NAI) policy in 2004 for new growth areas and added storm water quality standards in 2015. These policies have been very effective at reducing the adverse impacts of developments. The NAI policy requires no increase in flood discharges downstream from the property, no backup of floodwaters on upstream properties, no loss of floodplain volume on the developed property, and treatment of runoff for more frequent events to reduce pollutant discharges to streams and lakes. A minimum stream corridor policy was also adapted in 2004, which has significantly increased the amount of natural streams in recent development projects, as well as an associated buffer area for the environment and also helps to protect neighboring properties from flooding and issues with streambank erosion.

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Where does the runoff go?

Surface runoff from precipitation events in Lincoln drain to Salt Creek.

Is the current climate reflective of existing data?

Is the historical discharge-frequency record indicative of what we can expect for future discharge-frequency events? Not, necessarily. The past climate/rainfall doesn't predict the future. For example, the Technical Paper 40 (TP 40, National Weather Service) precipitation-frequency relationships were developed based on rain gage data from the 1960's or earlier. The updated data from the National Oceanic and Atmospheric Administration (NOAA) NOAA ATLAS 14 precipitation-frequency relationships were developed within the last 5 years. The additional 50 years of data shows an increase in the magnitude of the one percent annual chance (100-year) precipitation event of approximately 10 percent. The trend is an increase in the 100-year precipitation over time. If the precipitation value for a given event stayed relatively constant over time, we would call this "stationarity", this is not what the data suggests.

How often is the analysis of precipitation data updated?

As noted previously, the TP40 data was used as the standard for floodplain management for more than 50 years. It was replaced with the NOAA Atlas 14 data, which was developed approximately five years ago.

Why did flooding happen in March 2019, even though the rainfall was not as significant?

Rainfall amount and frequency do not always directly translate into flood frequency. For example, 4.7 inches of rainfall may be a 10 percent annual chance (10-year) event in the spring or summer. However, if the ground is frozen or saturated with water, less of the rain will soak into the ground and more runoff will be generated. The 4.7-inch rainfall event may create a 25-year or 50-year runoff event, if water can't infiltrate into the ground. In March 2019, we had a combination of snow, frozen or saturated ground, and rainfall that resulted in a runoff event that was between a 100-year and 500-year event in magnitude. The rain and snow alone were not sufficient to create such a large event.

What are some flood control projects Lincoln has completed?

The City of Lincoln and Lower Platte South NRD have completed many flood control projects, including the Antelope Valley Flood Control Project, the Upper Antelope Creek Flood Reduction Project, the Beal Slough Flood Reduction Project, and the ongoing Deadman's Run Flood Control Project.

What is the floodway and why is it larger in some areas?

The floodplain is the extent of the area that is inundated during a flood event. The floodplain includes shallower areas at the edges, where the flow is not as active. The floodway is the actively flowing portion of the floodplain that must be kept free from obstructions to avoid excess increases to the flood elevations due to "squeezing" the floodplain. In some locations, the active flowing portion of the floodplain is wider and, in some locations, narrower. The floodway is confined to the Salt Creek levees through the levee extents of the levees and through the use of flood storage areas landward of the levees.

How does precipitation impact design standards for detention cells, bridges, and storm drain systems?

- Detention cells are typically designed to offset (mitigate) increased runoff rates due to development for the 2-year, 10-year, and 100-year events.
- Bridges and roadway culverts are typically designed based on the level of service (how much traffic) and location. For example, a residential road in the City of Lincoln may be designed so that water doesn't overtop the structure during the 50-year event. A county road with little traffic may be designed to not overtop during a 5-year event.
- Storm drain systems are designed to convey the 5-year, or 10-year event in the infrastructure pipes. Excess flows travel along the curb and gutter of the street. Typically, the bypassed flows from larger events that don't make it in the storm drain system, are required to be contained within the roadway right-of-way.

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- If the rainfall amounts associated with the design event for a detention cell, bridge or culvert for a roadway crossing, or storm drain system change, that can have an impact on the cost to replace that infrastructure. Increased precipitation amounts typically lead to increased costs for the construction and maintenance of drainage features.

If rain events increase in frequency and volume should the city look at changing standards, or flood control solutions?

This is a foundational study to examine potential future measures for floodplain management and flood control. New regulations and flood control measures may be part of the recommendations that come forward from this report; but, are not specifically being brought forward for formal approval at this time.

What is the difference between precipitation data and discharge data?

Precipitation data is recorded by rain gages and is the measure of how much rainfall occurred. Precipitation data is usually measured and reported on an hourly or daily basis. Streamflow data is the measure of how much water is flowing in the stream. Streamflow can be measured on a continuous basis and we typically use the peak annual streamflow (peak streamflow for each year of the stream gage record) to analyze extreme flood events and develop an estimate of the flows for the one percent annual chance, or 100-year, regulatory event.

What do United States Geological Survey (USGS) stream gauges measure?

Stream gages measure how much water is flowing in a stream. The measurement is reported in cubic feet per second (cfs). Stream gage data is available from USGS, USGS Current Water Data for Nebraska.

What impacts streamflow?

Generally, the amount of flow in a stream is a result of the precipitation received and the ground surface conditions in the watershed. The more impervious (paved areas, roof tops, etc.) areas there are within a watershed, the greater and quicker the amount of runoff will be generated for a given rainfall event. If soils are saturated (can't soak up any more water), or if the ground is frozen, that can also lead to more runoff.

What role does temperature play in stream discharge?

Increases in atmospheric temperature have a direct influence on precipitation. Increased precipitation leads to increased stream discharges.

What are storm water quality challenges?

Water quality is different than floodplain management but some design items offer a benefit to both. Healthy floodplain corridors and minimum buffer stream corridors that include green spaces, can help improve water quality along our streams.

What is a levee?

A man-made structure, usually an earthen embankment, designed and constructed to contain, control or divert the flow of water to reduce the risk from temporary flooding. Levees are typically built parallel to a water way, to reduce risk on the "landward" side.

Where are the levees located and what areas do they protect?

The Salt Creek levees are along either bank of Salt Creek from Calvert Street in the south to Superior Street in the north (area red below). The levees protect numerous neighborhoods, commercial, and industrial areas (area in pink). The levees also help to provide protection for critical infrastructure like the Theresa Street Wastewater Treatment Facility and the Lincoln Electric System facility along North 27th Street.

Based on NOAA Atlas 14, is there an increase risk in downtown?

All the areas protected by the Salt Creek levees are at increased risk of flooding and flood damages. This includes the areas on the west and north side of downtown Lincoln.

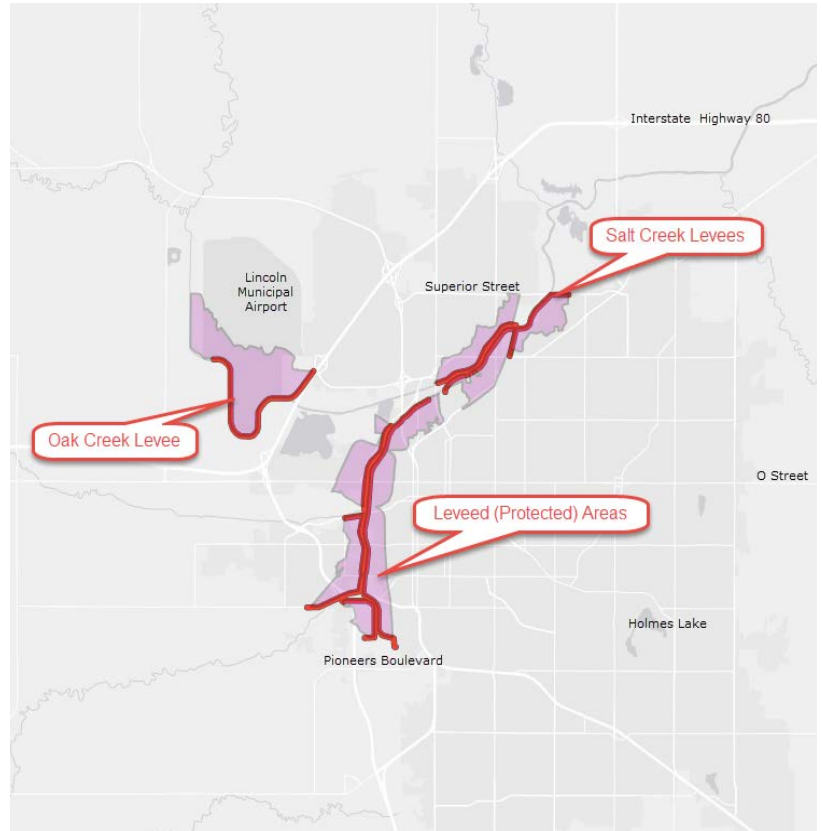
What are the conditions that would cause levee overtopping?

The levee generally provides protection and does not overtop for the approximate two percent annual chance (50-year) flood event. Minimal overtopping of the levees occurred during the May 2015 flood event.

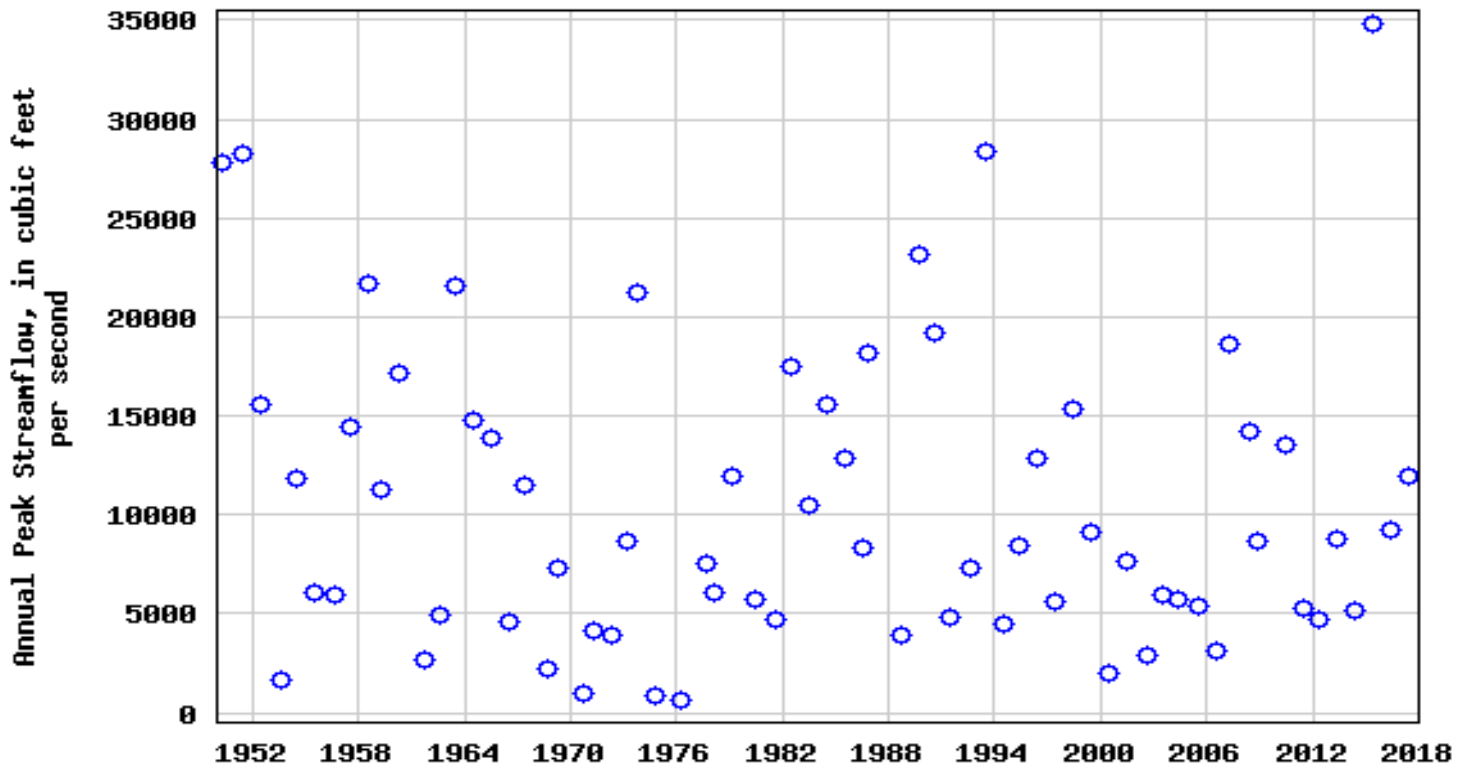
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Since the levee system was installed in the 1960's, in the last 50 years, how many flooding events has Lincoln experienced?

According to the USGS Gage 06803500, the flows in Salt Creek at North 27th Street have exceeded the 10-year flow rate seven times since 1970. The 50-year flow rate has been equaled or exceeded three times, and the 100-year flow event was exceeded once in 2015. The flood stage flow for the gage is approximately 16,000 cfs. The peak flow rates are 18,500, 24,000, and 30,100 cfs for the 10-year, 50-year, and 100-year events, respectively.



USGS 06803500 Salt Creek at 27th Street at Lincoln, Nebr.



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Are there flood control reservoirs (dams) in the Salt Creek watershed?

Salt Creek watershed has 10 large flood management dams, built by USACE and 66 smaller dams.

What does no adverse impact mean?

No Adverse Impact (NAI) means the action of one property owner does not negatively impact the flooding risk for other properties.

What is a detention area and what does it do?

Development creates more runoff due to more impervious surfaces, which causes an increase in runoff, quicker stormwater runoff to the stream, and an easier path for pollutants to get to local streams and lakes. Developments are required to maintain the runoff rates from preexisting development conditions and to account for stormwater quality discharges. Detention areas and stormwater quality areas are the areas reserved for holding stormwater, slowing it down to reduce runoff rates, and improve the downstream water quality.

Based on the new precipitation data (NOAA Atlas 14) future detention cells may need to be larger to accommodate the increased runoff that comes with larger rainfall events. The one percent annual chance flood event from Atlas 14 is approximately 10 percent larger than the precipitation used for the 100-year design storm today.

What other spaces can be used for detention?

The green space in city parks often provide flood storage as well as outlots in residential and commercial developments. One example of flood storage in a park is Wilderness Park along Salt Creek.

Why not do a project similar to Antelope Creek and widen Salt Creek so that the 1 percent annual chance flood is contained within the channel?

Since the early 1980's, when it was identified that the existing flood control project would not protect Lincoln from the 1 percent annual chance flood, the LPSNRD and the City of Lincoln have been working closely with USACE to address increasing the level of protection and structural integrity of the Salt Creek levee system. The most promising options to restore the level of protection of the levees to the 1 percent annual chance flood and potentially meet technical and economic feasibility have been evaluated as described in Section 4 of the report. Because of its probable high cost (e.g. bridge and utility replacements, taking of private property, and other items), widening the channel to accommodate the 1 percent annual chance flood below the bank elevations has not been evaluated in previous reports (see Section 4).

Why not raise the levees to contain the mapped Salt Creek floodplain between the levees?

Past studies of the Salt Creek floodplain conducted by the USACE have looked at numerous options to reduce flood damages and improve the level of protection provided by the levee system. A 1987 USACE study (described in Section 4 of the report) concluded "...that it is not economically feasible to improve the level of flood protection along the entire existing Salt Creek levee and channel project or to its original design level of protection (100-year);..." Other studies have inferred or come to the same conclusion (see Section 4).

Shouldn't there be a recommendation for the city to adopt the concept of "Sponge Cities" (i.e. use of practices to soak up water) to reduce the flow into Salt Creek to lessen flooding?

The "Sponge Cities" concept is very similar to Low Impact Development (LID). As described in Alternate

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Stormwater Best Management Practices (BMP's) Guidelines, City of Lincoln, Nebraska and the Lower Platte South Natural Resources District, April 2006 (<https://www.lincoln.ne.gov/city/ltu/watershed/bmp.htm>), LID commonly incorporates numerous best management practices to achieve environmental and economic benefits. Recommendations in this study for cluster subdivisions regulations, setbacks and riparian preservation, and low impact development regulations support the "Sponge Cities" concepts. In addition to these recommendations, there are many other voluntary practices that can be implemented by the public such as the installation of rain gardens, green roofs, using pervious pavement, and amending soils to increase infiltration, reduce runoff, and improve water quality.

Typically, these practices work well in more frequent rainfall events (i.e. smaller rainfall events that occur more often) and consequently work well for the purposes of stormwater quality. However, the "Sponge Cities" concept is typically less effective for larger rainfall events because the runoff volume greatly exceeds the capacity of the LID components to hold runoff. The intensity of rainfall in larger events can also create more runoff than the LID features can infiltrate. LID will not provide significant flood control benefits unless the LID practices are done very extensively and with significantly more capacity in both existing and developing areas.

What is the data on recent rainfall events as compared to historic events? Does the data provide evidence of the future climate model proposed in this study?

The current Flood Insurance Study (FIS) for Lincoln is based on precipitation data from the U.S. Weather Bureau's Technical Paper No. 40 (TP40), which dates from 1961. More up-to-date precipitation data, through December 2012, is contained in the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. The methodology used to determine future precipitation frequency estimates is described in Section 5.2.1 of the report and is referred to as Future (RCP8.5). Table 1 provides a comparison of precipitation values from TP40, Atlas 14, and Future (RCP8.5) for the 50, 10, 2, 1, and 0.2 percent annual chance precipitation events.

This data shows that the 50-, 100-, and 500-year 24-hour point precipitation values have increased since TP40 was published in 1961 and are expected to increase even more in the future. Comparisons of wettest years and other rainfall data nationwide and in the Midwest confirm this increase in rainfall values.

Table 1. Comparison of Corresponding 24-Hour Point Precipitation Values from Different Sources

Probability (percent annual chance)	Common Event Name	Total Precipitation TP40 (in)	Total Precipitation Atlas 14 (in)	Total Precipitation Future Conditions RCP 8.5 (in)
50	2-Year	3.00	3.03	3.21
10	10-year	4.69	4.47	4.83
2	50-year	6.00	6.37	6.94
1	100-year	6.68	7.31	7.97
0.2	500-year	8.18	9.75	10.73

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Can you define structural and non-structural floodplain management measures?

Structural floodplain management measures modify the flooding source. Examples would include measures like dams and levees.

Non-structural floodplain management measures modify the susceptibility of humans and the built environment to flooding. Examples would include elevating structures in the floodplain and removing structures from the floodplain. Another example would be open space preservation.

Were structural floodplain measures looked at in this study?

Yes. At a conceptual level, several flood control dams were looked at that would reduce flood levels for both the updated conditions and future conditions to the existing conditions level as identified in the report.

Did you look at the costs to implement the recommendations brought forward in the report?

No. The recommendations did include a qualitative evaluation of the cost to implement the recommendation as low, low-medium, medium, medium-high, and high.

**VIRTUAL TOWN HALL MEETING
JANUARY 26, 2021**

Did the study look at the impact of amending soils upstream from the city to increase the water holding capacity of soils and reduce stormwater runoff?

No. The study did not look at the issue of amended soils. Some of the recommendations in the report such as cluster subdivisions, low impact development regulations setbacks and riparian preservation are related to practices such as soil retention.

On page 65 please comment about the “study does not in any way constitute approved levels of future discharges and/or flood elevations.”

The study looked at levels of future flooding discharges and flood elevations on a conceptual level. They were not looked at in the depth required by federal standards. As such the information is for information only and will not be used as a basis for an approved flood map.

Does the study address water quality improvement?

No, not directly. The focus of the study was on water quantity issues (i.e. flooding).

Where funding is concerned, which criteria might different sources require? i.e. State Environmental Trust would like to see more riparian corridor and so forth?

See Section 7 of the report. Some outside funding sources are more appropriate for flood issues such as FEMA or USACE and others would tend to lend themselves more toward stormwater quality such as the aforementioned State Environmental Trust.

Will the City adopt design standards and restrict building as lots become vacated in South Salt Creek?

Not currently. It may be considered as a voluntary program in the future.

Will there be a future plan to reserve some of the more prone flooding land for parks or gardens?

Parks now and in the past tend to be along areas prone to flooding (i.e. stream corridors) as do outlots.

What are next steps?

Near term next steps are to coordinate some of the recommendations with the Climate Action Plan and as appropriate to revise the Drainage Criteria Manual and relevant Design Standards and Codes.

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Will the results of this study be moving uphill into all the reaches of Salt Creek. Will a map showing this rise be created for the built environment like the current floodplain map?

One of the recommendations is to remap the floodplain based on the updated rainfall amounts for the area from NOAA (National Oceanic Atmospheric Administration). When that is done, it will be done city-wide with the remapping based on federal standards.

What is the total property value, number of structures, and population at risk? What is the needed cost-benefit ratio?

Total property value, number of structures and population at risk was not looked at with this study. For federal funding, a cost-benefit ratio of more than 1.0 is needed (i.e. benefit greater than cost).

Did study consider a 24-hour 100-yr storm event across the watershed and how much the various options could reduce the flow through Lincoln?

The study did look at a 100-year storm event. At a conceptual level, several flood control dams were looked at that would reduce flood levels for both the updated conditions and future conditions to the existing conditions level as identified in the report.

What is the estimated cost to do the cost-benefit study to prioritize the 16 dam/storage basin options? Timing?

The estimated cost is unknown. The City is not going forward with a study to prioritize the 16 dam/storage basin options in the near term.

Will the City consider developing a relocation plan for relocating at-risk businesses and homes?

The City is planning to look at a voluntary program that would include floodproofing, house raising, house

relocation and other similar nonstructural practices for homes/businesses in the existing floodplain.

Most of the floodplain is outside the city limits. How is the City coordinating with Lancaster County to implement these recommendations?

The report concentrated on the floodplain within the City as that is where most of the infrastructure at risk is located. When a remapping effort is made in the future for floodplains in Lincoln, the City and NRD will coordinate with the County if there is any interest to do so by the County.

Should the City strongly encourage flood insurance?

The City does encourage flood insurance. The City is part of the Community Rating System and has a rating of five which is within the top 5 to 10% of the nation. The Community Rating System includes elements that encourage flood insurance.

For someone planning to develop property in the future, what steps should they take now to ensure that their improvements meet potential future requirements by the time they are ready to apply for a permit?

It is recommended to keep it out of the floodplain and build it a minimum of two feet above the existing floodplain due to the realization that when the floodplain is remapped in the future that floodplain elevations are going to rise.

Previously there was a plan to create a dry storage basin on Middle Creek? Any status given now that the City owns most of the proposed Middle Creek Basin?

The plan for Middle Creek from several years ago was determined to have a very low cost-benefit ratio that was well below 1.0. There is no plan to go forward with a detention pond currently.

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ADDITIONAL QUESTIONS VIA EMAIL

Did the study consider a program of incentives to upstream farmers to use the techniques described by Nebraska experts in this Omaha World Herald article “Let this soak in: roots in soil between crops can reduce flood impact, UNL researcher says”?

Incentives for upstream farmers for soil retention were not directly addressed in the Salt Creek Resiliency Study. It is addressed indirectly with some of the discussions in Section 1 of the report on open space preservation (Section 1.2, best practice no. 1 on page 7) and also in Section 2 of the report on setbacks and riparian preservation (Section 2.9, best practice No. 3 on page 42-43). Some of the recommendations in the report (cluster subdivisions, low impact development regulations, setbacks and riparian preservation) are related to practices similar to soil retention by having areas or protecting areas in the future to have less runoff than what has been standard development practices in the past.

What prompted this study? Why now?

The study was done because of the increased understanding of the future impacts of flooding. Recent major flooding events in 2014 and 2015, updated national rainfall records and the increased national and local recognition of future flooding impacts lead to the need for the study.

Did the study established the number, square foot, value of properties of existing and newly added into the flood prone areas (100,500yr)? Residential vs commercial?

The items above were not addressed in the study. The increased floodplain area is based off new rainfall data but did not follow the FEMA process for formal adoption. The above items will be looked at more closely when proceeding forward with the formal process for obtaining federal approval for an updated floodplain based on current data.

What is the annual incremental cost of flood insurance to existing properties in the flood prone areas? Annual cost for new flood prone properties? Residential vs commercial?

The incremental cost varies. It is dependent upon many items, including if it is a pre-FIRM building, where the floodplain is in relation to the first floor, use of structure and the value of the structure. This information was not requested in the scope for the study.

What is the ranked prioritization of the potential upstream dams/storage basins? How does that ranking differ from a ranking based on cost-benefit?

Upstream dams/storage areas were not ranked.

Does the study make any dam/storage basin recommendations today? At what cost? How will the study recommendations mitigate the increase in flood elevation?

No recommendations were made in the study for dams/storage basins. Section 6.2.6 and 6.2.7 of the Report provide information on potential structural flood management measures and results. Very preliminary costs from the report are \$140M for 16 dams. Full build out of these dams would not remove the floodplain from behind the levees.

What federal funding is available? What are the matching requirements? What NRD funding is available? How would the City raise the funds to pay for its share?

Funding is discussed in Section 7 of the report. Different sources of funding have different levels of matching requirements. Typical federal agencies for major floodplain projects are FEMA and the Corps of Engineers. FEMA cost shares in the past have been around 75% federal and 25% local. The Corps is usually less unless the project

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size fits a relatively small project level. Both of these federal agencies require a minimum of 1:1 cost/benefit ratio. Typically need to be higher to get in the queue to be considered for a project.

NRD funding is coordinated on a year-to-year basis in advance of the NRD's fiscal year. Planned expenditures of large cost shares by the NRD are coordinated well in advance (e.g. as in Antelope Valley).

Typically, City funds for drainage-type projects come from stormwater bonds. Very large projects that require a City cost share more than bonds can handle would need to be funded elsewhere (e.g. as in Antelope Valley).

What is the maximum flow capacity through the Lincoln portion of Salt Creek (cu. ft. per hour?) without exceeding current levee heights, etc. under current conditions?

Under the current conditions the levee has the capacity to contain around a 50-year flood event through Lincoln (approximately 36,000 cubic feet per second upstream of 10th Street). Per hour, that would be about 129,600,000 cubic feet/hour.

Should there be a 24-hour 100-year storm event across the entire Salt Creek watershed, what would be the estimated flow through Lincoln's stretch of Salt Creek? Maybe your estimate of acre-ft of water in a 12-hour period.

The 100-year event for Salt Creek is around 45,000 cubic feet per second upstream of 10th Street. Converting to acre-feet over a 12-hour period would be coincidentally about 45,000 acre-feet of water.

Is there a list of the stakeholder and/or advisory committee members who worked on the Resiliency Study?

This information is on the Salt Creek Study website at <https://www.saltcreekstudy.com/stakeholders>.

Go to the third stakeholder meeting and click on the Public Education Plan. The list is on page 5.

It seems most of the options suggested in the study would apply to new development. But what about the existing areas and built capital already in the floodplain or in the future floodplain (which updated maps will show)? The recommendations I see here do not really address the areas, neighborhoods, homes, and businesses most vulnerable to flooding now. If we don't address the risk to these vulnerable populations, then we haven't succeeded.

There are some items in the recommendations to address the existing environment. One of the items that is active and continues to be underway is the CRS program noted in the presentation. The CRS program includes educational items to make citizens aware of floodplain issues and what they can do (e.g. an annual brochure is sent to all property owners who have property in the floodplain). The City also has items online with information about protecting yourself and your property from flooding (e.g. Drainage Information for Property Owners). Another item is Voluntary Buyouts. This program in the past has been project-based but funding options are being considered to make this a funded program not dependent upon a project.

As you read through the report the survey of national and the selected community best management practices in regards to the existing environment is based on communications, education, some maintenance, buyouts, and items that homeowners can do on their own (e.g. rain gardens).

Many of the recommendations in the study are carried through to the Climate Action Plan which includes related draft items regarding flooding impacts to the existing community (e.g. coordination with Lincoln-Lancaster County Emergency Management, the NRD, Urban Development develop a communications plan and breach/overlapping analysis for affected residents).