CITY OF WASHINGTON, ILLINOIS
Public Works Committee Agenda Communication

Meeting Date: June 6, 2022

Prepared By: Dennis Carr – City Engineer

Agenda Item: Citywide Stormwater Study Final Report

Explanation: TWM has finalized the stormwater assessment and management report. On the last page of the report, they have a list of projects they identified totaling just over $26 million. They assigned mitigation points dependent on the flooding frequency as well as the buildings mitigated inside the flood area to give a list of eight priority projects. This condensed list totals $7.2 million.

The eight projects in prioritized order are:
L* Walnut Street and Adams Street storm sewer: $1,300,000
C* Grandyle Drive relief storm sewer: $700,000
K* South High Street and South Cedar Street storm sewer: $1,900,000
B* Northridge Lane backyard storm sewer trunk line: $1,200,000
U* Locust Street storm sewer: $300,000
A* Meadowview Lane storm sewer: $600,000
Q* Knollaire storm sewer: $720,000
E* Enlarged Patricia (Pin Tail) Street detention basin: $450,000

The priority projects are spread across the City with at least one project in every Ward. Two of these projects sit in the southeast corner of the city (L and K), where storm sewer inlets are largely only at the intersections or roads that have no storm sewer at all. This area will also likely see an increase in stormwater runoff as a result of the need for I&I mitigation following the smoke testing project. This could exacerbate the issue. While no road has been selected to be reconstructed after Hilldale, there has been a lot of internal conversation about the condition of Catherine. Project K would need to also account for any reconstruction done to Catherine.

Generally speaking, the local projects will have a more targeted reduction to heavier impacted homes. They will also increase the flow of tributaries because we are giving the water a quicker path to the tributaries. This could increase the need for bank stabilization projects that were not quantified in this study.

The large regional detention basins did not receive as many mitigation points largely because the flooding downstream of these basins is largely property/yard nuisance flooding and the price tags are higher. Most regional basins will also require the acquisition of property or easements. The acquisition itself will depend on if the property owner is even willing to sell the property for a basin. Bloomington attributes their decrease in damage from a 2021 two-day 100+ year storm event to their regional detention basins.

The regional basins are the only projects that will directly impact the tributary flooding and help reduce downstream erosion without changes to existing basin sizing. Slowing down the tributary flow reduces the chances of having bank and roadway failures during large storms. Increasing existing basin sizes and reducing basin outfall flows would also aid in tributary flows. Adjusting our code to decrease flow from and to increase storage capacity of basins is a possibility, but it will likely come at a reduction in future development. While this would aid to reduce future issues, it won't do anything with the current tributary flows.

Fiscal Impact: The increase in sales tax will generate roughly $1,000,000 in revenue for stormwater projects.

Recommendation Summary: Discussion on the stormwater study, priority projects and the path forward for stormwater mitigation.

STORMWATER ASSESSMENT AND MANAGEMENT REPORT

MAY 10, 2022

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I. Project Summary & Background

In March 2021, the City of Washington, Illinois issued a Request for Proposals seeking a qualified consulting team to perform a comprehensive stormwater assessment study of the existing stormwater infrastructure and tributary drainage areas in Washington. This study would also examine various improvements that could alleviate pervasive flooding and ponding issues within the City along with increasing channel and streambank erosion. Upon being awarded the project in April 2021, Thouvenot, Wade & Moerchen, Inc. and its subconsultant, Fehr Graham Engineering & Environmental, began a comprehensive topographic survey of the City's existing stormwater infrastructure and developed various stormwater analyses to determine the existing infrastructure's effectiveness.

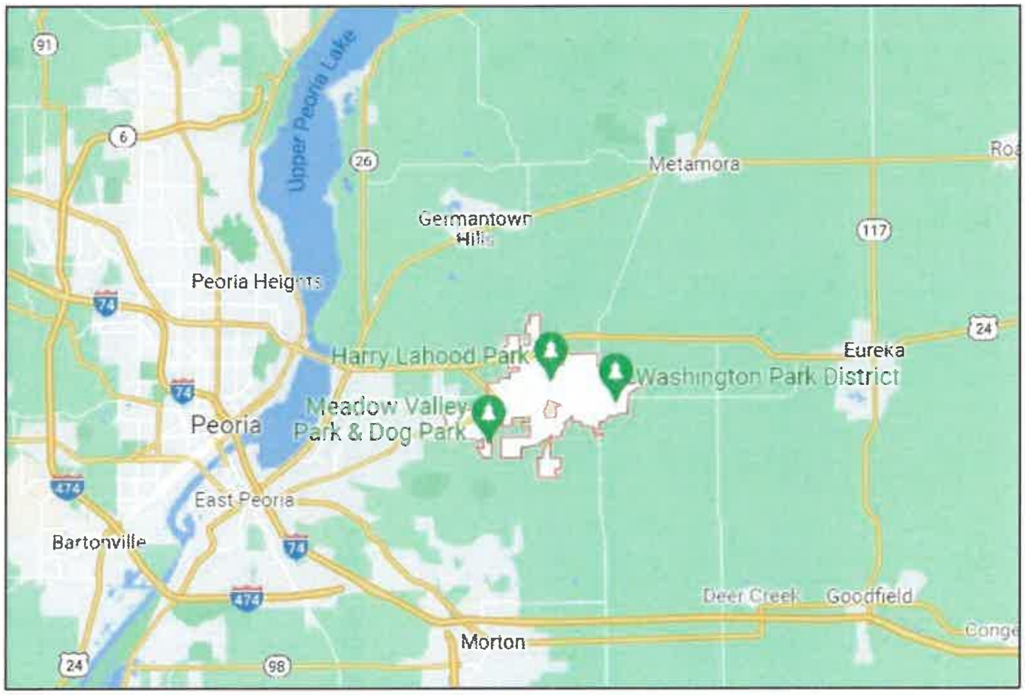

Figure 1. Aerial location map.

The City of Washington is located approximately 5 miles east of the Illinois River near Peoria, with Washington's most immediate major receiving waterway being Farm Creek. A large portion of Washington's southern areas are crossed by Farm Creek, with several of its named tributaries as shown on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) extending to the north (see FIRMs 17179C0055E and 17179C0060E). Many areas within Washington's limits have established 100-year (1% chance of occurring in any given year) Base Floodplain Elevations (BFE) per the FIRMs.

Table 1. Summary of FEMA-defined waterways in Washington City limits.

Waterway	Floodplain Type	BFE Range
Farm Creek (Sections V-AH)	AE	705-742
Tributary No. 1	AE	728-748
Tributary No. 1A	A	Not Studied
Tributary No. 2	A	Not Studied

To aid in pinpointing areas of emphasis, a location map of various drainage complaints by residents was provided by the City. A review of recent years' rainfall has showed that a July 2020 storm likely generated a large number of these complaints. In addition, there are many areas where larger tributaries to Farm Creek pass directly along common back lot lines and present greater risk to homes because of the reduced amount of floodplain compared to these channels' pre-developed conditions.

In general, discussions with City personnel have centered on reducing overland flooding near homes and the possibility of large regional detention basins to limit runoff approaching more populated areas of the City. By performing a detailed analysis of the City's existing drainage conditions, a comprehensive strategy can be developed that focuses on maintaining existing infrastructure, prioritizing future projects for maximum risk reduction, and identifying potential funding mechanisms for future improvements.

Summary of Priority Improvements

After conceptualizing projects throughout Washington, a vetting process was applied to the improvements to determine which projects should be prioritized moving forward. Since flooding was a major focus of the complaints, a flood mitigation score was tabulated for each project based on the risk of flooding within its vicinity. Higher scores mean that the area will flood more frequently and cause more damage than other areas without improvements. The number of habitable structures that would be protected from the 100-year storm after improvements was considered as well. Finally, the project area must have reported a flooding issue to the City for a project to be included as a priority. More outreach can be done for areas that show severe flooding in the models but have not been verified by property owners. The following table lists projects in ranked order according to the criteria as discussed in this section.

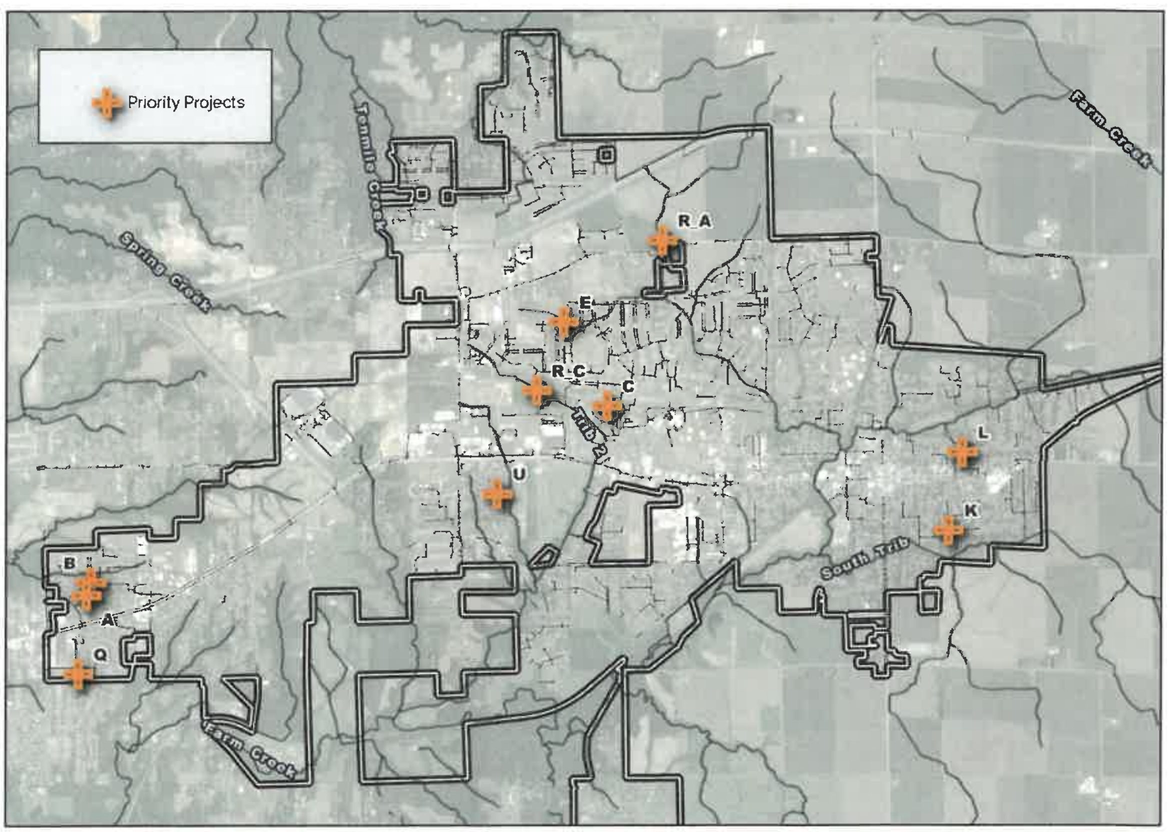

Figure 2. Priority project area locations.

Table 2. Priority project area locations.

Project	Mitigation Points	Cost	Buildings Mitigated	Cost/Building Mitigated
Project L	11.8	$1.3M	18	$72,000
Project C	7.3	$0.7 M	20	$35,000
Project K	4.1	$1.9M	9	$211,000
Project B	3.3	$1.2M	11	$109,000
Project U	2.6	$0.3 M	3	$100,000
Project A	2.3	$0.6M	8	$75,000
Project Q	2.0	$0.72M	11	$65,000
Project E	1.7	$0.45M	7	$64,000
Total Cost for Priority Projects:		**$7.2 Million**		

II. Evaluation of Existing Conditions Analysis

Beginning in April and continuing for several months thereafter, TWM's survey crews performed an extensive topographic survey of the storm sewer and drainage systems throughout the City. In total, 753 manholes and junction boxes, 2,293 inlets, and 522 outfalls and flared end sections were surveyed to determine each element's elevation, size, and depth. In general, traditional surveying techniques were used to collect this data. Upon being processed, each surveyed element was added to a Geographic Information System (GIS) data viewer. This GIS information will be transferred to the City for its use in maintenance, planning, and future improvements.

The City's topography was determined with the use of Tazewell County's available Light Detection and Ranging (LiDAR) information, which is collected with a method similar to sonar measurements and allows for a topographic map to be created in various software applications. In this case, the software program *QGIS* was used to delineate the sub-basin acreage and the amount of impervious surface within each sub-basin to determine a composite runoff coefficient.

To determine the impacts of various storms on the City's infrastructure, rainfall data was obtained from the Illinois State Water Survey's available online information. In particular, "Bulletin 75" was updated within the last several years and includes rainfall amounts for storms of various duration and frequency. The City of Washington is located within climatic section 4 per this document.

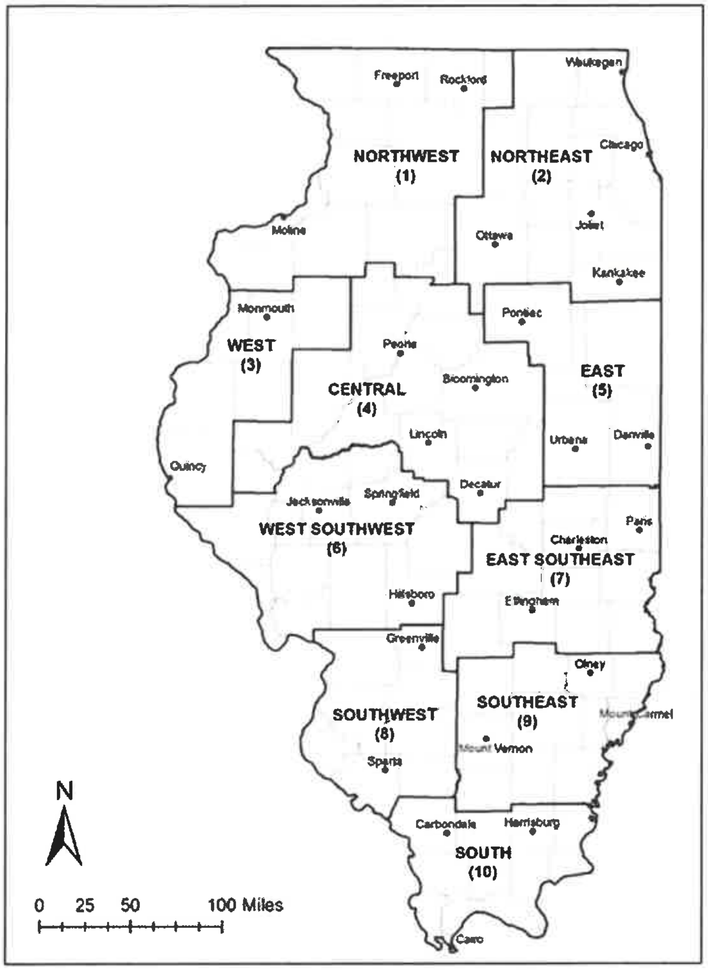

Figure 3. Climatic sections of Illinois per Bulletin 75.

To assess the existing storm sewer systems within the City, the sub-basins area and curve numbers were input to the software program *PCSWMM*. In conjunction with the GIS data of the City's storm sewer infrastructure, a comprehensive model of the storm sewers was created. In addition to determining if the existing pipes and inlets were of adequate size, areas of localized flooding could be determined through the program's 2D flow analysis. Graphical depictions of overland flow were generated and compared against the nearby home extents to determine areas of substantial risk to homeowners.

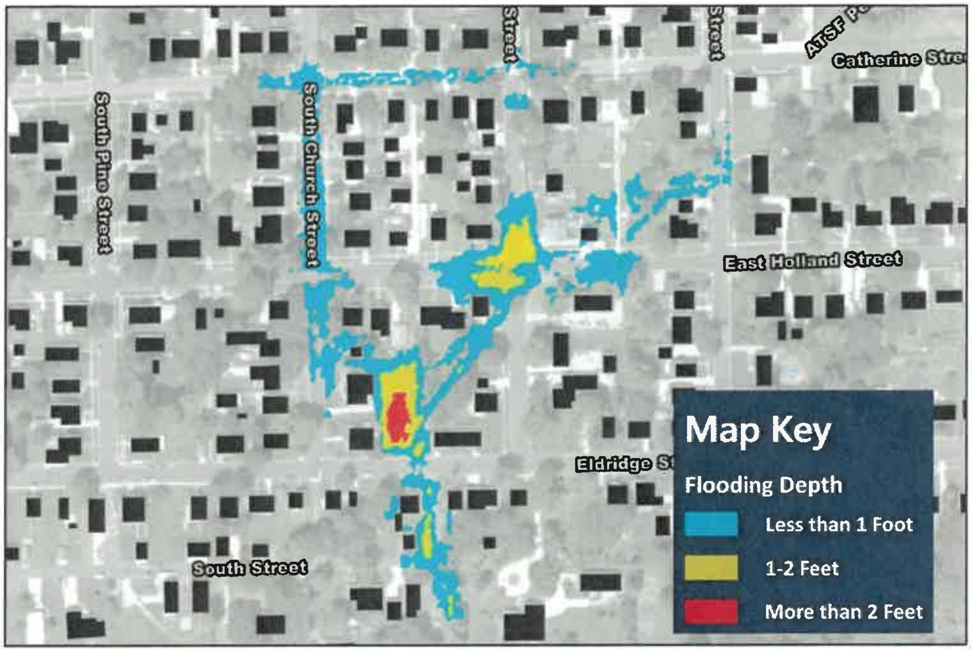

Figure 4. Typical analysis results showing ponding areas from undersized storm sewers.

The delineated sub-basins' runoff characteristics were also used in conjunction with the United States Army Corps of Engineers' (USACE) software program *HEC-HMS* to calculate flows from each drainage basin for several storm frequencies. The SCS curve number loss method was used with the Clark Unit Hydrograph transform method to determine the peak runoff values and hydrographs were developed for multiple points along each tributary. These hydrographs were then input to the software program *GeoHECRAS* to determine high-water elevations and flooding extents within riverine areas. All reaches were analyzed with one-dimensional, steady-state modeling except for the area near the intersection of Devonshire Road and Main Street, which included a two-dimensional flow area modeled with unsteady-state flow values.

III. Summary of Existing Conditions & Findings

The existing conditions analysis showed that there are numerous areas of flooding during a 100-year storm event. Some of the main areas of concern are:

- The backyard swale that runs through the Washington Estates subdivision.
- MacKenzie Street between Kingsbury Road and Gillman Avenue.
- The intersection of Wilmor Road and Kern Road.
- East Jefferson Street between South Cedar Street and South Pine Street
- The homes adjacent to Farm Creek as it runs through the city center.
- Tributary 1 where it runs through the backyards as well as a few homes along Tributary 1A.
- Tributary 3 where it runs through the backyards.

These areas all show residential homes being flooded. The analysis appears to align with many of the areas where residents have complained about flooding issues during previous storms.

In addition to the results of the analysis, a review of Washington's Code of Ordinances was undertaken with respect to drainage and stormwater design. Though the Code is quite comprehensive, there appear to be some requirements that could be strengthened to provide greater protection for downstream properties as the result of future development. In particular, the current Code allows for the discharge from 100-year storms to pass over the emergency spillway of detention and retention basins and detention ponds are only required to contain the 25-year storm event. To align this design with the FEMA FIRMs and national flood insurance requirements, a change in Code could be considered stipulating that the emergency spillway invert elevation should be at least 1' above the 100-year high-water elevation (HWE) in the pond while requiring ponds to store the 100-year storm volume. This would provide greater storage in all detention ponds and significantly reduce the peak outflow from new developments.

Table 3. Washington Code drainage requirements and proposed suggestions.

Element	Current Design Requirement	Code Section	Recommended Design Requirement
Rainfall Data	ISWS Bulletin 75	53.004.C.4	-
Minimum Time of Concentration	15 Minutes	53.004.C.4.a	5 Minutes
Runoff Coefficients			
- Undeveloped Farm Ground	0.25	53.004.C.4.c	-
- Commercial/Industrial Developments	1.00	53.004.C.4.d	-
Storm Sewer and Appurtenances	25-Year Storm	53.004.A	50-Year Storm for Public Streets
Inlet Spacing	Not Specified	N/A	10-Year Storm
Stormwater Detention Storage			
- Minimum	2-Year Storm	53.004.C.1	-
- Maximum	25-Year Storm		100-Year Storm Additionally, to simplify the design criteria, removing the need to evaluate a pre-development 2-year storm and the need for the city to review it, setting a standard allowable release such as 0.2 cfs per acre is recommended.
Emergency Spillway Elevation	Passage of 100-Year Storm	53.004.C.5.d	Invert Elevation 1' above 100-Year HWE
Overland Flow Route	100-Year Storm	53.005.A	Add Requirement that Adjacent Home Lowest Openings be 1' above HWE

The recommendations shown in Table 3 are more stringent than nearby municipalities. For example, the City of Peoria also requires that stormwater detention be designed for the 2- and 25-year storms, similar to the City of Washington's current ordinances. However, these conservative recommendations would provide an additional level of safety for the City's residents and business, both new and existing. Ultimately, the City of Washington will need to weigh the benefits of protecting both existing properties and new developments against the potential adverse impact on courting new development that more stringent ordinances may bring.

IV. Evaluation of Potential Infrastructure Improvements

Two locations have been discussed by City personnel for use as regional detention facilities. The first (labeled "Regional C") is located west of the termination of Elgin Avenue near that street's intersection with Gillman Avenue near Washington Estates Subdivision and is noted as parcel 02-02-15-300-021 per Tazewell County. The second area (labeled "Regional A" and "Regional B") is made up of the combined parcels 02-02-11-300-007 and 02-02-15-200-040 north of Dallas Road and West Cruger Road.

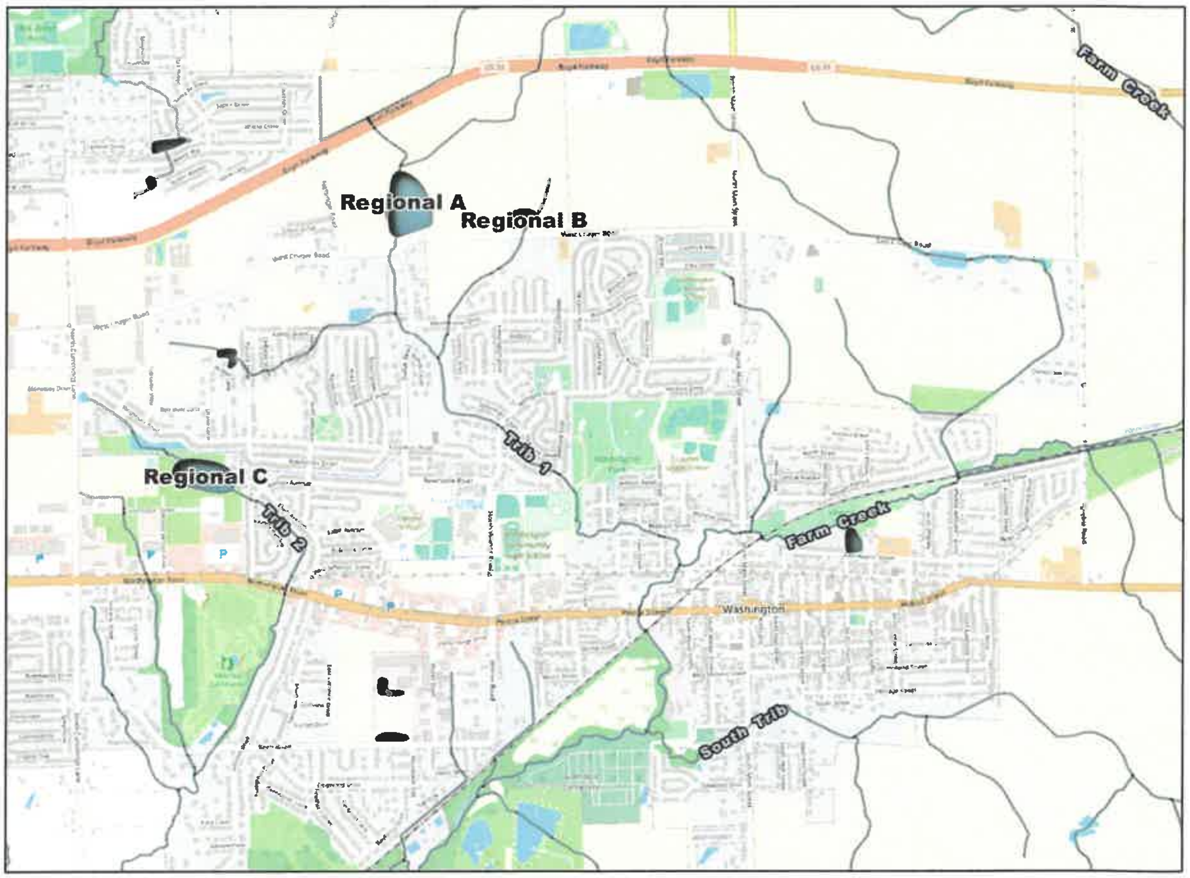

Figure 5. Proposed regional detention locations.

The parcels north of Cruger Road are owned by the City and are shown in Figure 5 as the sites of "Regional A" and "Regional B." The Washington Estates Subdivision has been the source of several drainage complaints by City residents, with the common back lot lines between Elgin Avenue and Fayette Avenue carrying the upper limits of Tributary 2. Though the upstream parcel for regional detention is not owned by the City and would require land acquisition, limiting the flows of Tributary 2 with the construction of "Regional C" would mitigate the flooding risks for many homes upstream of Washington Road and would also create more advantageous headwater conditions for the culvert beneath Washington Road.

An alternative project in Washington Park was reviewed to assess the effectiveness of storing more water before the stream meets Farm Creek. This project is in an already developed area and its impact on downstream properties was limited, so it appears less attractive to the City than the Cruger Road basins.

The box culvert that runs under Washington Road carrying Tributary 2 could be upsized to help alleviate the backyard flooding in Washington Estates by allowing more water to pass through. This could be done either as an alternative to installing a detention pond at the upstream end of Tributary 2 or in conjunction with a pond's construction, though the pond appears to be the most effective solution and would negate the need to upsize this culvert. Potential improvement project costs and their effectiveness in this area can be found in Appendices C and D.

There are several properties that could be acquired to restore the floodplain and allow for additional carrying capacity and habitat restoration along Tributary 1 and Farm Creek. The impact of this is difficult to quantify and the volume reduction would not be as significant as the large detention storage options, but this would help to improve the water quality and reduce erosion if implemented correctly. Some examples of parcels that would be well-suited for this are parcels 02-02-13-309-014, 02-02-14-421-008, 02-02-14-307-003, 02-02-14-300-019.For this to be effective, the existing land would need to be dug out to provide room for the flood waters to expand and native plants could be planted to increase infiltration and reduce nutrient/sediment loads.

The South Tributary between Holland Street and Melvin Street showed potential flooding of several homes during a 100-year storm event. The severity of the flooding along this tributary is lower and does not impact as many residents as the other tributaries that were analyzed. A large portion of the drainage basin for this tributary is undeveloped agricultural land. If this land were to be developed in the future, it could cause the current flooding conditions to worsen. Areas such as this would benefit from an updated, more stringent drainage code to prevent new flooding issues from arising in the future.

The proposed plans developed by others to enlarge the ditch near Hilldale Avenue were modeled to ensure that this project would be a cost-effective way to reduce flooding. Based on the model, it appears that this ditch would have a noticeable positive impact on flooding. There are seven homes that appear to have flooding or have flood water come within a few feet of the home in the 100-year existing condition. The ditch was calculated to have a capacity of 220 cfs, while the 100-year storm was found to produce a peak flow of 290 CFS along this reach.

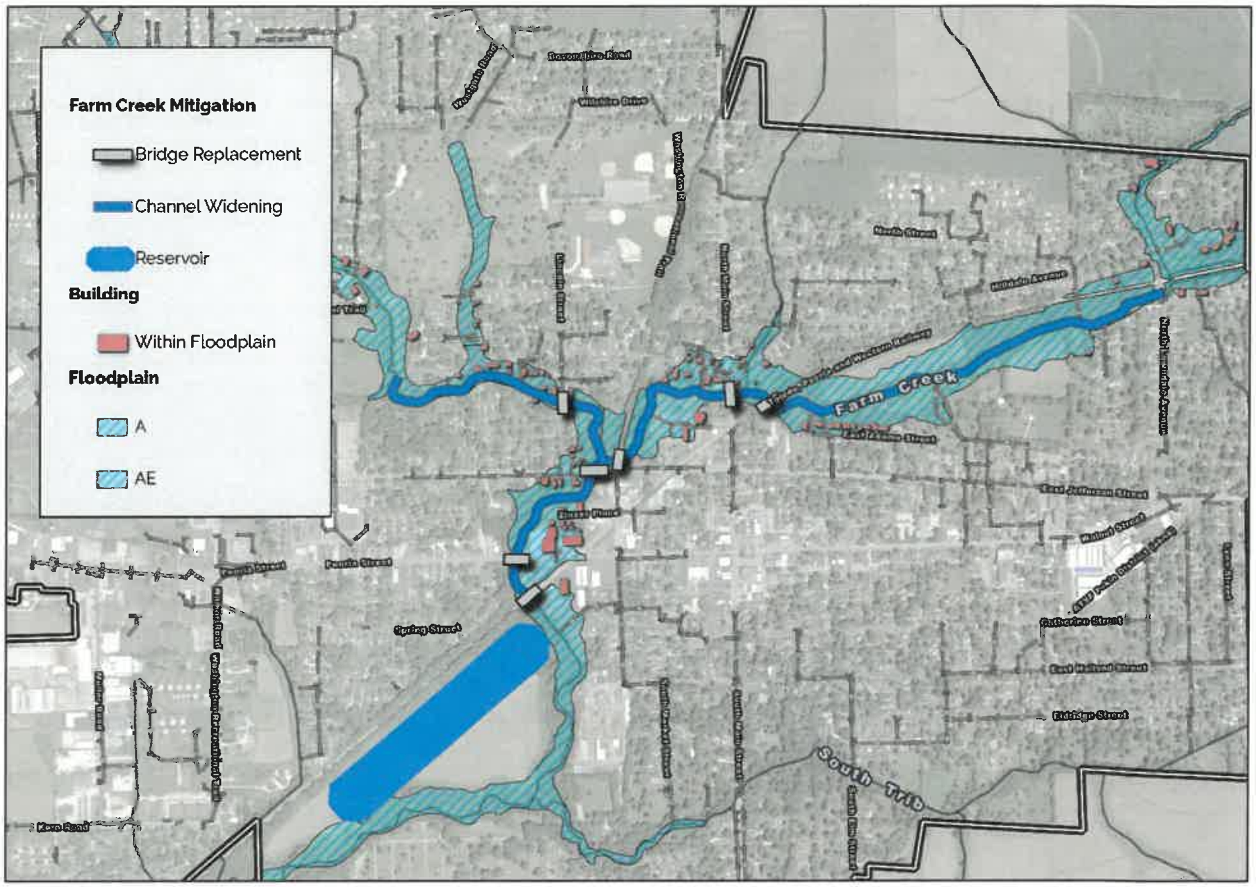

Figure 6. Farm Creek flooding extents.

There are dozens of homes and businesses within the floodplain of Farm Creek near downtown. This area generated no comments of drainage or flooding issues, but risk is still present due to the proximity to Farm Creek. A mitigation option in this area could consist of channel widening, bridge replacements, and construction of a downstream reservoir to attenuate flows. The preceding figure shows the potential layout of improvements. Constructing this option would likely cost more than $20 million, which is much larger than other projects considered in this plan. This option was not modeled but is based on engineering judgment for similar locales in Illinois. Outreach should be done in this area to confirm the scale of issues property owners are facing. If it is deemed necessary, modeling and conceptual alternatives could be completed in the future.

Urban Flooding Projects

Urban flooding occurs in developed areas and is most severe during short intense rain storms. These are often called flash flooding events. The infrastructure that conveys inland areas outside of major streams is the focus of these projects. The following figure displays the location of all the potential projects that have been reviewed for this study. These can take the form of ditch, storm sewer, or stormwater storage basin improvements.

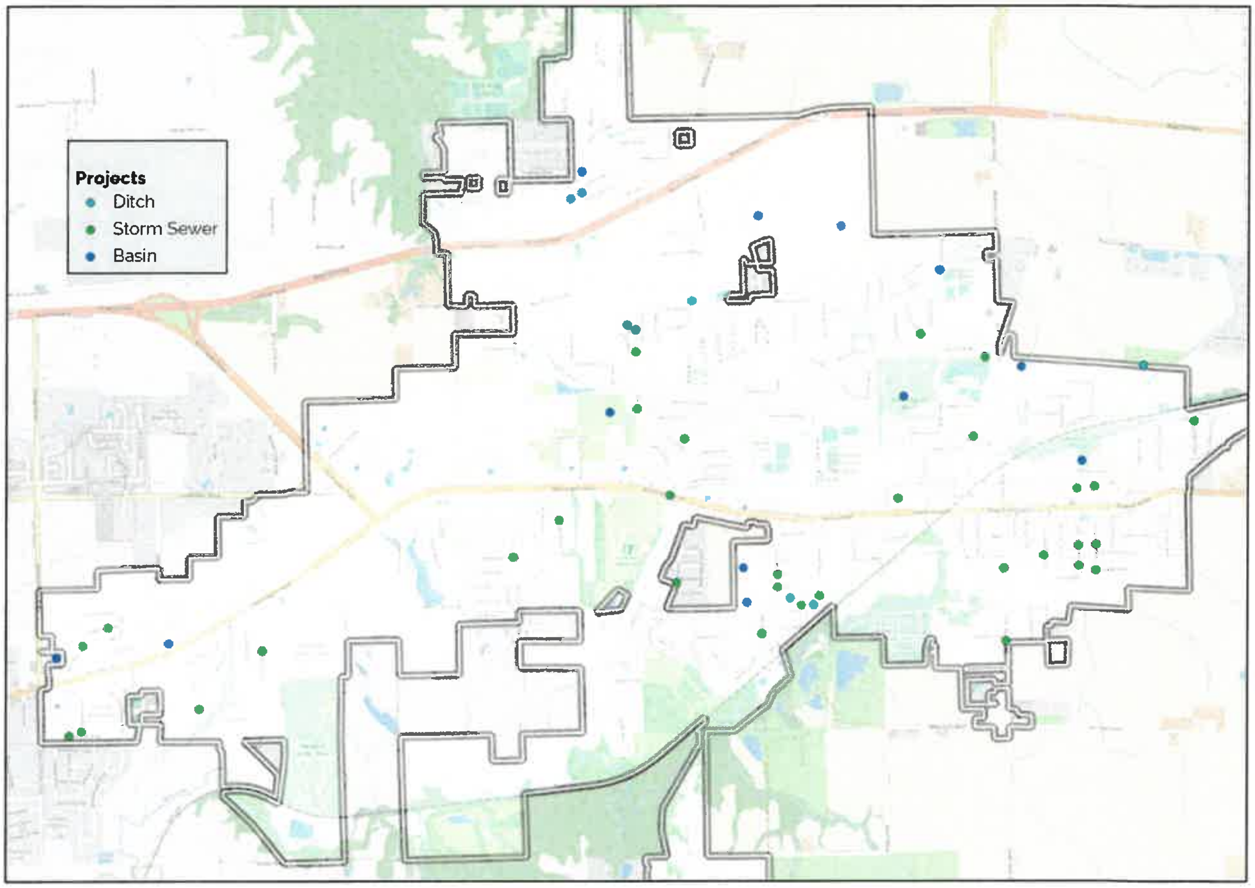

Figure 7. Location of various improvement projects addressing urban flooding.

Kelsey Street Ditch: The homes along the north side of Kelsey Street have experienced flooding issues within their backyards. Based on the topography, it appears that this is due to excess runoff from the adjacent agricultural land flowing directly into the yards through breaks in the berm built to protect these homes. To help alleviate this issue, the existing berm could be mended and a 2'-high berm could be extended along the back lot lines from Grandyle Street to the retention pond on the east. This berm would catch and divert runoff from the field directly to the pond. An analysis was done showing a maximum normal depth in this ditch of 18" during a 25-year storm event.

Patricia Street and Pintail Lane: The detention pond north of Pintail Lane causes backup of the storm sewers upstream along Pintail Lane. Disconnecting the low point of Pintail Lane from the pond or reconfiguring the pond to have a lower high water level could reduce the impact during large rain events.

Austin Avenue Ditch: The drainage ditch from Cummings Lane to Jadens Way has limited capacity and causes backyard flooding in its vicinity. Grading a new ditch or building a pond would help convey water without causing overflow. Additionally, the existing pond north of Jadens Way could be regraded to add storage capacity for these options. Development west of this area should be regulated to retain the 100-year storm event in its stormwater management facitilities.

Breeze Way and Easy Street: Overflows from this intersection drain southwest towards properties along Westminster Drive. Constructing a storage basin would control overflows and convey them to downstream storm systems.

Devonshire Road Storm Sewer: Devonshire Road is the main conveyance route for the runoff from 50 acres of the surrounding neighborhood. The system cannot handle storm events larger than the 10-year storm and the low point of the road near Westgate Road is inundated, impacting surrounding homes. The storm sewers could be upsized to increase capacity of the storm sewer system and not allow as many flooding events.

Wilshire Drive Storm Sewer: The low point on Wilshire is drained by a small storm sewer. When the storm sewer is overwhelmed, overflows go uncontrolled towards the row of multi-family housing units along Main Street. Increasing storm sewer capacity and grading an overland flow path would limit the impact of flooding events.

Crestview Drive Ditch: The ditch on the north side of homes along Crestview Drive does not have capacity for the drainage coming from farm fields to the northwest. Improving the ditch grading would ensure the waters are conveyed to the small tributary of Farm Creek that runs through the neighborhood.

Brookcrest Drive Storm Sewer: The intersection of Miller Street and Brookcrest Drive is a low point that is inundated during rain events. This has the potential to spread and impact the surrounding homes. Conveying drainage at the intersection north along Brookcrest would improve the outflow from this area and decrease the impact of flood events.

Jefferson Street and Spruce Street Storm Sewer: A large section of downtown's aging storm sewer system cannot handle rain events in excess of a 10-year storm. The area bounded by Harvey Street, Walnut Street, Pine Street and Adams Street would benefit from increased storm sewer capacity. Draining these areas to Adams Street and Church Street would alleviate upstream flooding, but a detention basin before these areas discharge into Farm Creek would be ideal so increased flows do not negatively impact downstream areas.

East Holland Street Storm Sewer: Similar to Jefferson Street, this area's aging storm sewers are overwhelmed in heavy rainfall events. The area is bounded by Holland Street, Cedar Street, South Street, and Elm Street. Upsized storm sewers would assist with conveyance from this area. Catherine Street is being reconstructed and inlets and storm sewers from this area can be connected to the project so that both areas benefit.

Main Street Storm Sewer North: The intersection of Main Street and Catherine Street is a low area that floods due to the capacity of the surrounding storm sewer systems. A larger storm sewer down Main Street would help drain water away from this area during storm events.

Main Street Storm Sewer South: Overland flow exits Main Street ROW 600 feet south of Oakwood Drive. Flows traverse homes and property west of Main Street before entering Oakwood Drive and Eilers Court. Improving storm sewer capacity along Main Street would limit occurrences of overflows to this area.

Washington Recreation Trail Storm Sewer: Monroe Street west of Main Street and near Farm Creek receives drainage from Lincoln Grade School. The upstream area does not have a defined drainage path to Monroe Street and homes are susceptible to flooding in large rain events. Constructing a storm sewer along the recreational trail would collect waters from the school and surrounding homes and convey them to Farm Creek.

Michael Street Storm Sewer: Michael Street west of downtown is not served by storm sewers. Proposed storm sewers would improve drainage for this street and surrounding properties.

Muller Road and Kern Road Overflow: Runoff from 50 acres of drainage flows to the low spot of Kern Road near Amanda Lane. When the ditch on the north side of Kern Road is overwhelmed, water drains across Kern Road to the south and impacts numerous properties near Glenn Street. Improvements to the storm sewers and ditches north of Kern Road would reduce the risk of overtopping Kern Road and of flooding for residents to the south.

Kern Road and Westfield Way Drainage: The open space north of Kern Road drains to a culvert under Kern Road, then to a series of ditches and storm sewers within the neighborhood to the south. Water overtops Kern Road and the ditches in large rain events. A diversion storm sewer could be constructed along Woodland Trail to divert drainage to Farm Creek and avoid flooding the neighborhood to the west.

Parkview Drive Storm Sewer: The neighborhood north of Kern Road along Hillcrest Drive floods during large rain events. Constructing larger storm sewers within the neighborhood would improve capacity and reduce the risk of flooding.

Grandyle Drive Storm Sewer: The neighborhood west of Central School has a large network of storm sewers and detention ponds that convey drainage from over 50 acres to Tributary 2. Storm sewer improvements would provide additional capacity and relieve some of the flooding the residents experience.

MacKenzie Street Storm Sewer: The low corner of MacKenzie Street near Kingsbury Road fills and overtops into adjacent properties from the right of way. The City can improve drainage by installing a new storm sewer with increased capacity for this area and connecting to Tributary 2.

Locust Street Storm Sewer: The neighborhood bounded by Linsley Street, Locust Street, Linden Street, and Sterling Street is drained by driveway culverts and ditches. Flat terrain and small culverts slow water down and nearby homes are flooded. Construction of a new storm sewer from Linden Street to the drainage ditch east of the neighborhood would alleviate flooding.

Brookshire Drive Storm Sewer: A low spot on Brookshire Drive fills with runoff from upstream areas and surcharging storm sewers during heavy rain events. A storm sewer from the low spot to the ditch east of Cummings Lane could be constructed to improve drainage capacity and reduce the frequency of flooding in the neighborhood.

Wagner Street and Peach Street Storm Sewer: The neighborhood bounded by Ernest Street, Hope Street, Peach Street, and Washington Road is drained by driveway culverts and ditches. Culverts were not sized for the increasing flows at the low points in the neighborhoods. Constructing storm sewer along Wagner Street and Peach Street to add capacity in the bottom of the watershed would alleviate flooding for residents in this area.

Meadowview Lane and Northridge Lane Storm Sewer: The neighborhood northeast of Washington Road and Summit Drive experiences flooding along some of its overland flow paths, which travel through private property and along homes. Construction of storm sewer along Meadowview Lane and Northridge Lane will improve drainage conditions and alleviate flooding.

Knollaire Drive Storm Sewer: Low spots on Lynnhaven Drive and Belaire Drive near Knollaire Drive fill during heavy rain events and nearby homes are likely impacted. A relief storm sewer from the low spots to an outfall on Summit Drive will reduce flood frequency for this area.

Impacts of Future Developments

The City indicated that parcels 02-02-10-300-015 and 02-02-22-204-043 could be developed in the near future. Both parcels drain to the northeast between Jadens Way and Austin Avenue. This area has reported flooding issues and a project is recommended in the previous section. It would be beneficial to downstream areas to restrict the proposed outflows for all storm events below the existing peak flow rates.

Figure 8. Location of Parcel 02-02-15-100-009 (Pintail Lane and Patricia Lane).

Another area of interest is parcel 02-02-15-100-009, where a portion of this could be acquired to expand the detention pond on Pintail Lane. Based upon previous flooding, the pond is likely undersized. This pond eventually outfalls to the pond north of the Trails Edge Subdivision so reducing flows from this pond could also help alleviate flooding concerns at that pond as well as reduce flows entering Tributary 1.

In addition, over-detention of runoff could be encouraged on Parcel 02-02-14-100-045 of Devonshire Estates Development when this phase of the subdivision is developed. The effectiveness of this would largely depend on how it is connected to the detention pond to the south.

Figure 9. Location of Parcel 02-02-14-100-045 (future Devonshire Estates expansion).

V. Potential Funding Opportunities

To assist with funding for these projects, a FEMA Flood Mitigation Assistance (FMA) grant could be obtained, which requires cost-sharing between FEMA and the City. There is also an option for funding through the USACE Continuing Authorities Program that would also require cost-sharing between FEMA and the City. However, the following sources of funding seem most realistic:

Stormwater User Fee

Illinois communities have the authority to create a user fee system for public utilities. Enterprise funds are the most common model for funding water and sewer infrastructure improvements. Many communities in Illinois are now using this approach for stormwater and the City of Washington joined suit in 2022 with a 0.5% sales tax increase that was passed in. City estimates have concluded this tax could generate nearly $1 million each year. The proceeds could also be used as the dedicated funding source for IEPA low interest loans, which otherwise would not be available for stormwater projects in Washington.

EPA CWA Section 319 Grant

The Illinois Environmental Protection Agency (IEPA) administrates the federal Clean Water Act (CWA) Section 319 grant program. The program oversees watershed planning and infrastructure improvement projects. Typical grant projects are awarded for watershed based plans, which are reports that outline water quality issues and improvement projects, and watershed improvement projects. Generally, the construction projects that are awarded grants were documented in an approved watershed based plan. So two steps are necessary to access the funding.

1. Create a watershed based plan
2. Apply for grants for projects specifically listed in the watershed based plan

VI. Pollutant and Water Quality Modeling

Over 90% of the City of Washington is tributary to Farm Creek. A Total Maximum Daily Load (TMDL) has been developed for Farm Creek as a part of ongoing evaluation of the larger Middle Illinois River watershed basin. The specific pollutants and reduction goals are detailed in the following table.

Table 4. Pollutants and reduction goals for Farm Creek.

Watershed	Pollutants of Concern	Pollutant Reduction Requirement (%)	Potential Sources
Farm Creek	Chloride	75	Watershed, streambank, and gully erosion; urban and agricultural runoff; livestock access to waterways; animal agriculture; untreated sewage; NPDES facilities; CSOs
	Total Suspended Solids	88	
	Nitrogen	20-65	
	Phosphorus	32-76	

Additionally, an implementation plan was prepared for Farm Creek from its confluence with the Illinois River to the Farmdale Reservoir. This detailed report outlined sources of pollution and possible improvement measures. Since the watershed is adjacent to and includes a small portion of Washington, much of the material is applicable to Washington and upstream areas.

1. Causes of Impairment and Pollutant Sources

Farm Creek flows through several densely developed and populated areas of the city of Washington. It originates on the northeast side of the City and empties into Peoria Lake, and ultimately the Illinois River, traversing a large portion of Washington along the way. The watershed topography is largely influenced by the Illinois River as the upstream areas have steep slopes and variation in terrain, while the lower portion is flat and appears to be the floodplain that was shaped when the Illinois River valley was formed.

The other major source of impairment to water quality is the nature of the development within the watershed. Urban areas produce higher concentrations of non-point source pollutants than natural areas, which propagate downstream and continue to compound their impact. Residential, commercial, and agricultural areas make up the majority of the watershed area and each of these land uses have qualities that can lead to pollutant loads that distinguish them slightly from the other uses. The conversion of pervious land with the ability to soak in water and filter pollutants to impervious areas allows water to quickly run off and continue downstream unfiltered.

Another outcome of development is the quantity and velocity of water that flows to streams within the watershed. Though the lower portion of the watershed is concrete, some of the upper sections are in a relatively natural state. These streams are experiencing excessive flows and velocity from upstream areas that is causing extensive erosion of streambanks, which itself is a source of excess pollutants. Soils that are eroded during rain events carry solids and nutrients.

2. Pollutant Load Calculations

Farm Creek was divided into subwatersheds to break down the analysis of non-point source pollutant loading, as shown in red in the following figure. Typical event mean concentrations (EMCs) of pollutants were applied to annual runoff volumes to get the annual pollutant loadings in pounds per year. Water quality modeling on its own is not an excellent predictor of water quality loads but the event mean concentrations generally produce very predictable ranges of pollutants as compared to benchmark values set by the Illinois Environmental Protection Agency (IEPA). A breakdown of the land uses for each subwatershed follows.

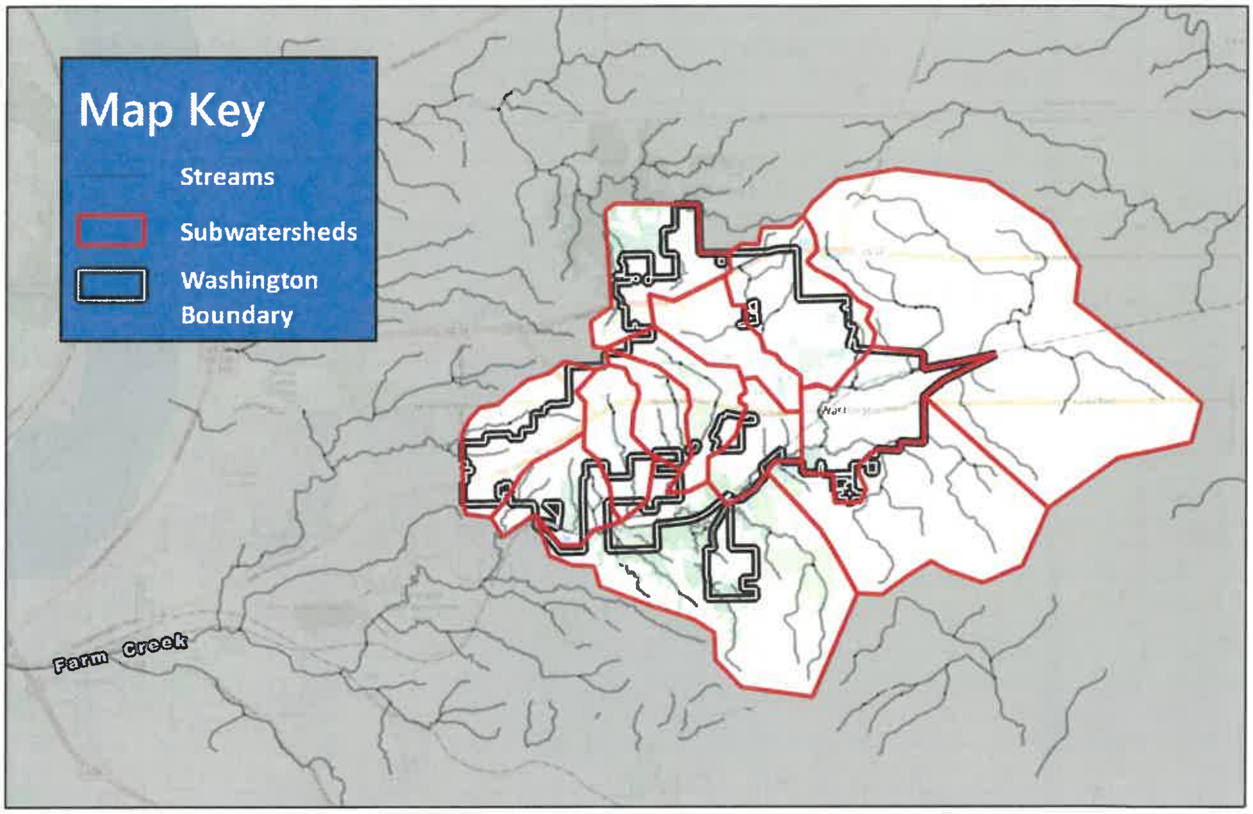

Figure 10. Pollutant load subwatershed locations.

Table 5. Non-point source pollutant loading quantities.

Subwatershed	Commercial	Residential	Transportation	Open	Farmland
Cherry Tree	19	40	4	22	17
Devonshire	3	40	2	6	49
Downtown	9	70	2	10	10
Farm Creek Offsite	0	2	1	1	97
Farm Creek Offsite South	0	1	0	23	69
Farm Creek S Branch Offsite	0	1	0	3	95
Firethorn	23	45	3	18	11
Harry LaHood	9	52	3	8	28
Hillcrest	11	47	2	25	15
Hunters Glen	3	47	2	19	30
Meadow Valley	2	33	0	62	2
Rolling Meadows	14	41	4	28	13
West Lake	10	26	2	40	23

Modeling was performed in the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) program. The program utilizes average annual rainfall, EMCs, streambank conditions, soil, and land use data to predict runoff and subsequent annual pollutant loadings. In addition to simulating the annual pollutant loadings, the BMP pollutant load reductions are calculated based on the type of BMP and the area and land use draining to the BMP. STEPL was used in this project to model the reduction of pollutant loadings based off of stream bank stabilization possibilities throughout the watersheds. The results of the watershed modeling are shown in Table 1 below.

As you can see, heightened levels of pollutants are predicted. These loadings will be the basis of the goals of reducing non-point source loads within the watershed. Modeling was also performed in the Storm Water Management Model (SWMM) software, more exactly the PCSWMM software by Computational Hydraulics International (CHI), which utilizes the EPA SWMM computational engine developed by EPA. This software utilizes average annual rainfall events, EMCs, land use data, as well as imperviousness percentages to get annual pollutant loadings in both pounds and tons per year. PCSWMM was used to model the reduction of pollutant loadings based off of the implementation of retention basins throughout the watersheds. These results can be seen below in Tables 7-9.

Table 6. STEPL pollutant loadings without BMP.

Watershed	N Load (no BMP)	P Load (no BMP)	Sediment Load (no BMP)
	lb/year	lb/year	t/year
Farm Creek	77137.9	19691.9	13024.7

3. Project Based Pollutant Reductions

Many projects were identified during the planning process. These projects can be grouped into the following subcategories:

- Retrofits
- Stabilization
- Naturalized Areas
- Planning

The main priority for implementation was grouping effective pollutant reduction with other needed improvements, whether open space enhancements, flood reductions, or otherwise.

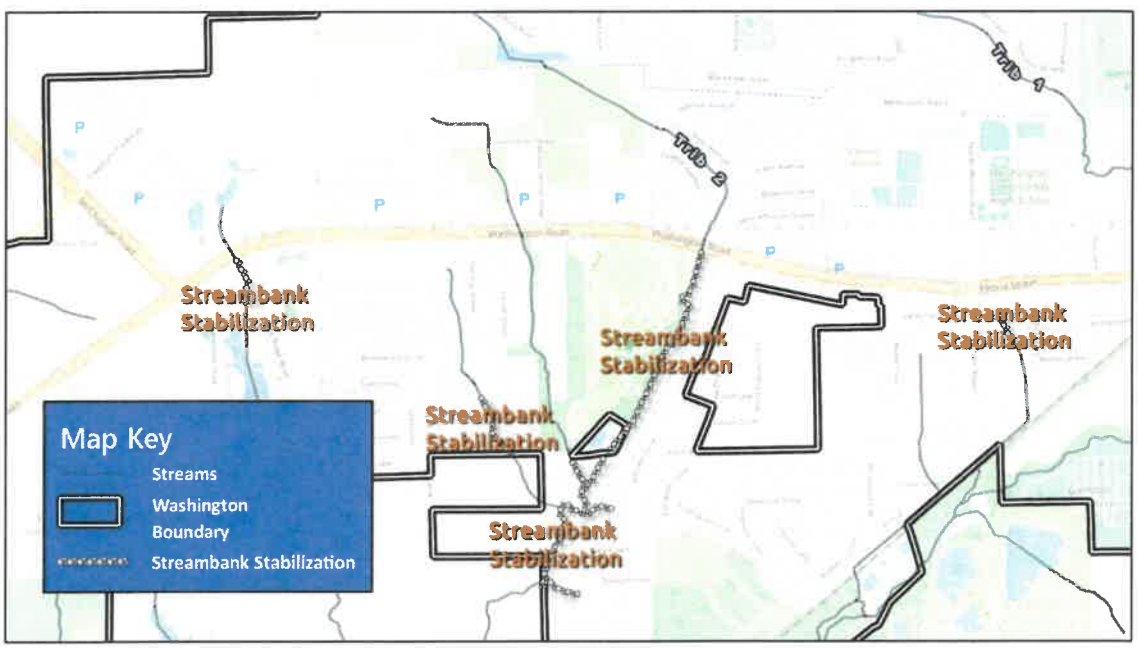

Figure 11. Proposed streambank stabilization locations.

Each project was analyzed for its pollutant reduction capability and its ability to control and infiltrate the amount of runoff that drains to it. Appropriately sizing the BMP areas was a key consideration of the planning process and was done using site specific runoff volumes. Eight basins were modeled in PC SWMM to find the reduction in pollutant loadings as a result of implementing stormwater flood mitigation projects. 8,400 feet of streambank stabilization was modeled with STEPL to determine the reduction in pollutant loadings. The following tables detail the reduction in pollutant loads in the watershed using the two different models.

Table 7. STEPL Pollutant Loading Reductions (Streambank Projects).

Watershed	N Reduction	P Reduction	Sediment Reduction
	lb/year	lb/year	t/year
Farm Creek	1475.6	568.1	922.3

Table 8. PCSWMM Pollutant Loading Reductions (Detention Basin Projects).

Watershed	N Reduction	P Reduction	Sediment Reduction
	lb/year	lb/year	t/year
Farm Creek	1649.1	386.0	135.0

Table 9. Combined STEPL and PCSWMM Pollutant Loading Reduction Percentages.

Watershed	% N Reduction	% P Reduction	% Sediment Reduction
	%	%	%
Farm Creek	2.21	2.73	5.16

The contents of this report, the previously completed Farm Creek implementation plan, and the previously completed Farm Creek Restoration Plan serve as the basis for the major work of preparing a watershed plan. This report and additional details on financing, project implementation, and milestones could be submitted to IEPA for review as a watershed plan, in turn making included projects eligible for grant funding.

VII. Summary and Future Recommendations

TWM, Inc. and its subconsultant, Fehr Graham Engineering & Environmental, have gathered topographic data, prepared a GIS application for the City's use, and analyzed the City's various existing storm sewer conveyance systems. The City's storm sewer systems drain into Farm Creek and its tributaries at various points before Farm Creek flows west towards Peoria and the Illinois River. The existing conditions within the City are detailed in Appendix B, with the effects of proposed improvements shown in Appendix C. Preliminary improvement cost estimates have been included in Appendix D for these various projects and are intended to assist the City as future budgets are developed.

The results of the topographic survey have been included in a GIS application for the City's use in maintaining the existing City infrastructure. As part of this deliverable, a form of software called Decision Optimization Technology (DOT) will reference the GIS data for the City's storm sewer infrastructure. The DOT will allow the City to assign its own grading and risk factors when maintaining its system. Should the City's needs change over time, this software can be continuously updated with new factor scoring and maintenance reports of the infrastructure. This will allow for a truly hands-on approach to maintenance that will outlast this particular report and provide City officials, both present and future, with an effective tool to assess the City's infrastructure's conditions.

VIII. References

J.R. Angel and M. Markus. "Precipitation Frequency Study for Illinois (Bulletin 75)." Illinois State Water Survey

Illinois Department of Transportation. "Illinois Department of Transportation Drainage Manual." July 2011.

Tetra Tech, Inc. *Middle Illinois River Total Maximum Daily Load and Load Reduction Strategies*." August 9, 2012. http://www.epa.state.il.us/water/tmdl/report/illinois-river/final-tmdl-report.pdf.

Tetra Tech, Inc. *North Farm Creek and Dry Run Tributary Implementation Plan*." December 2012. http://www.epa.state.il.us/water/tmdl/report/illinois-river/farm-creek-dry-run-implementation-plan.pdf.

Appendix A

Effective Flood Insurance Rate Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or flood plain management.

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NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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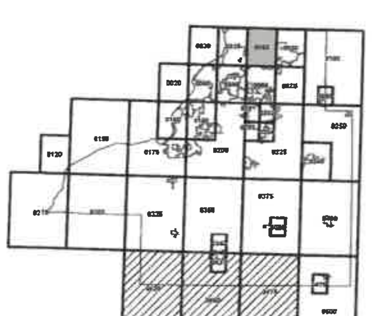
PANEL INDEX



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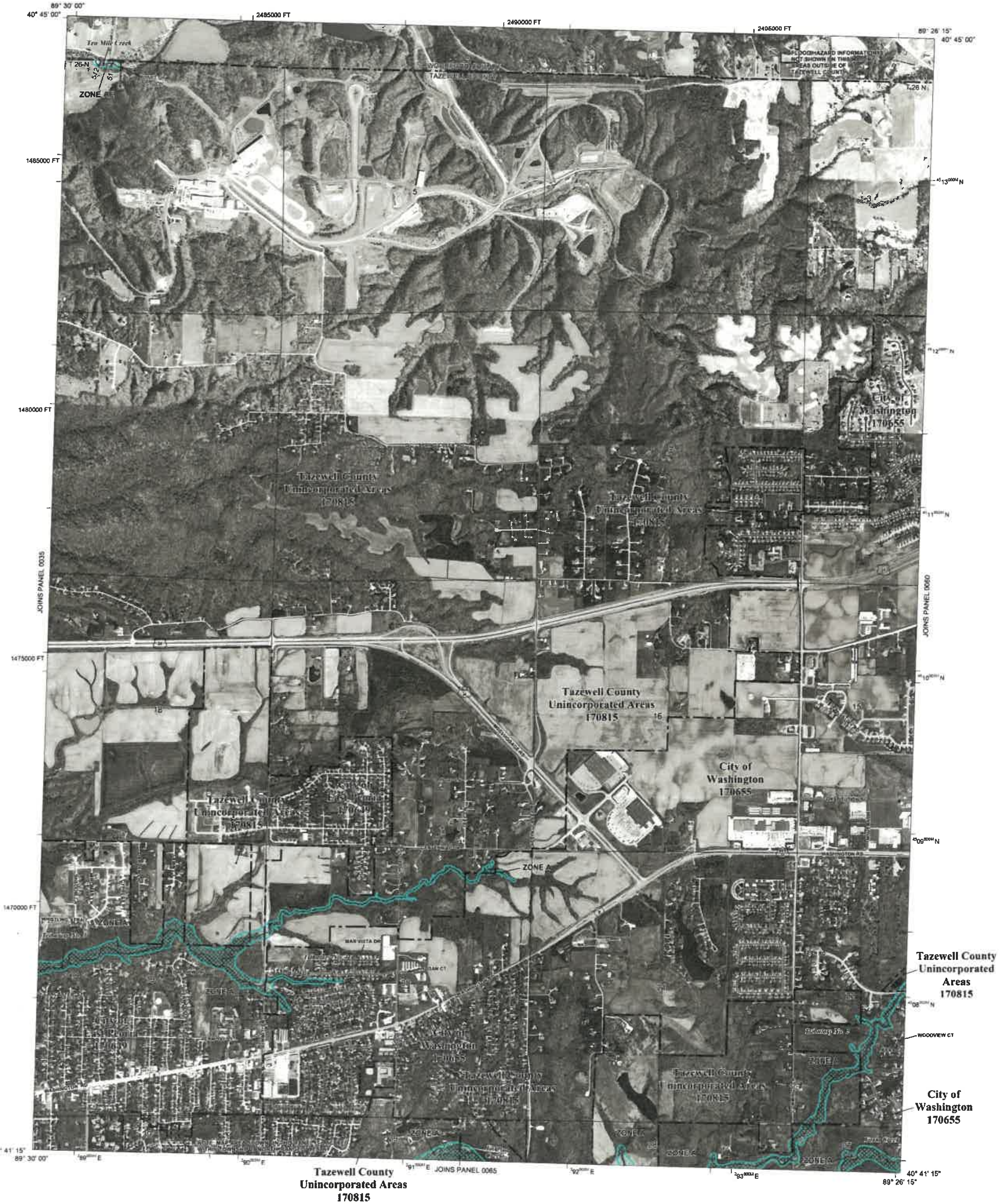

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~513~~~	Base Flood Elevation line and value; elevation in feet*
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(A)———(A)	Cross section line
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45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{45}89^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 16
1565000 FT	5000-foot grid tick: Illinois State Plane West Coordinate System, 3801 zone (FIPSZONE 1202) Transverse Mercator
DX5510 x	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 17, 2017

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0055E

FIRM

FLOOD INSURANCE RATE MAP

TAZEWELL COUNTY, ILLINOIS

AND INCORPORATED AREAS

PANEL 55 OF 500

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EAST PEORIA, CITY OF	170649	0055	E
TAZEWELL COUNTY	170815	0055	E
WASHINGTON, CITY OF	170656	0055	E

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MAP NUMBER
17179C0055E

EFFECTIVE DATE
FEBRUARY 17, 2017

Federal Emergency Management Agency

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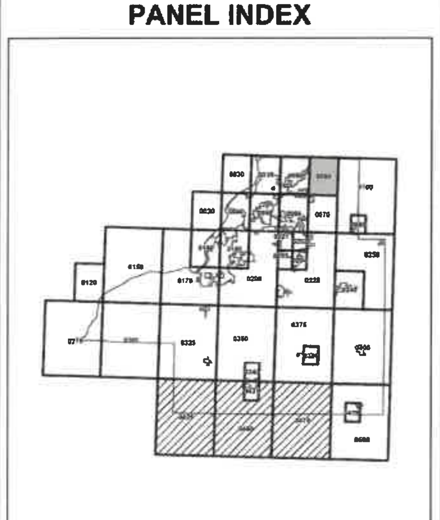

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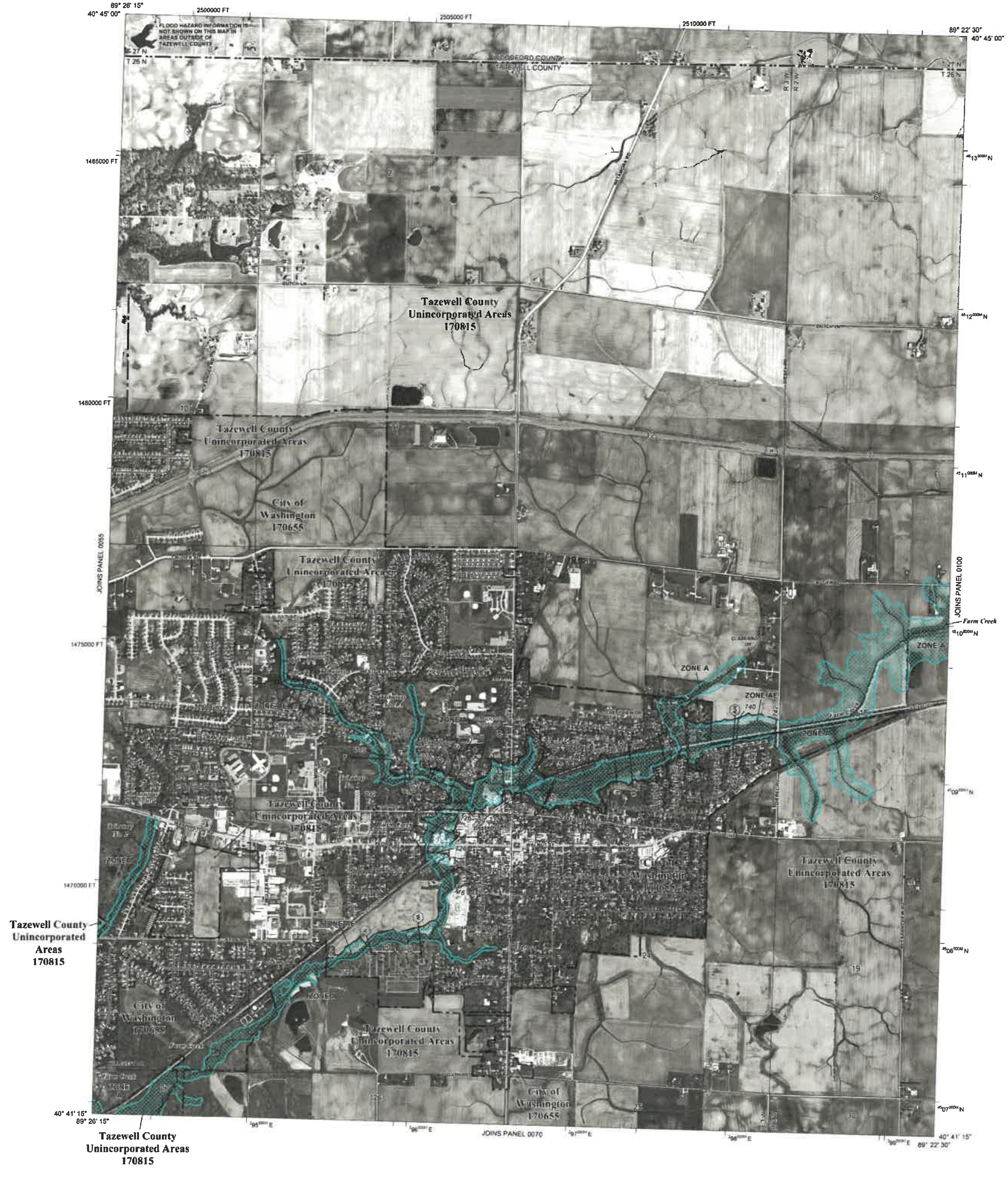

LEGEND

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FLOOD INSURANCE RATE MAP
FEBRUARY 17, 2017

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NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0060E

FIRM
FLOOD INSURANCE RATE MAP
TAZEWELL COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 60 OF 500

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
TAZEWELL COUNTY	170815	0060	E
WASHINGTON, CITY OF	170655	0060	E

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MAP NUMBER
17179C0060E

EFFECTIVE DATE
FEBRUARY 17, 2017

Federal Emergency Management Agency

WASHINGTON
ILLINOIS

Appendix B
Existing Inundation Maps

WASHINGTON
ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 FLOODPLAINS NORTH (EXISTING CONDITONS)

B.01

WASHINGTON
ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 FLOODPLAINS SOUTH (EXISTING CONDITIONS)

B.02

WASHINGTON ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: TRIBUTARY 2 FLOODPLAINS (EXISTING CONDITIONS)

B.03

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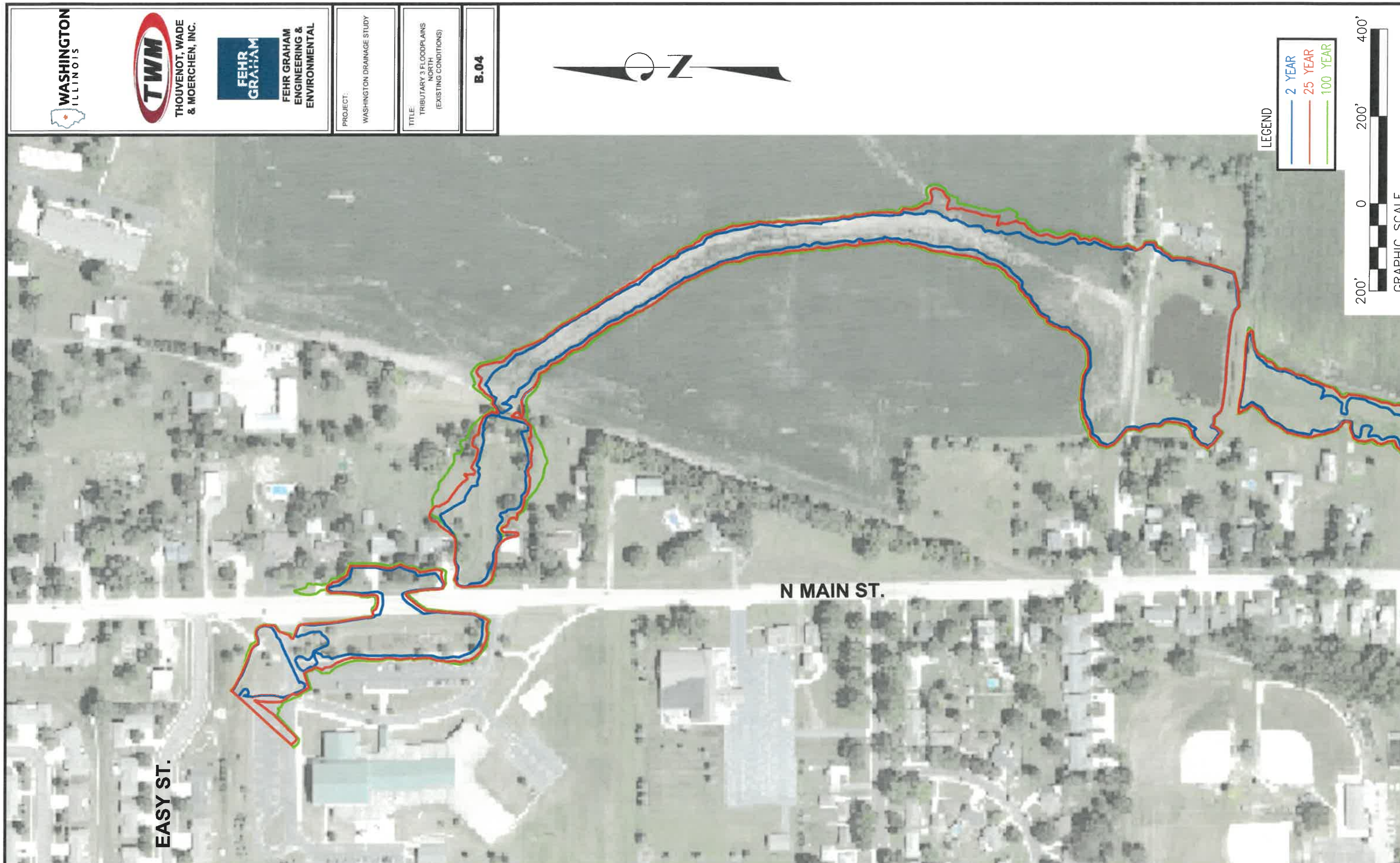
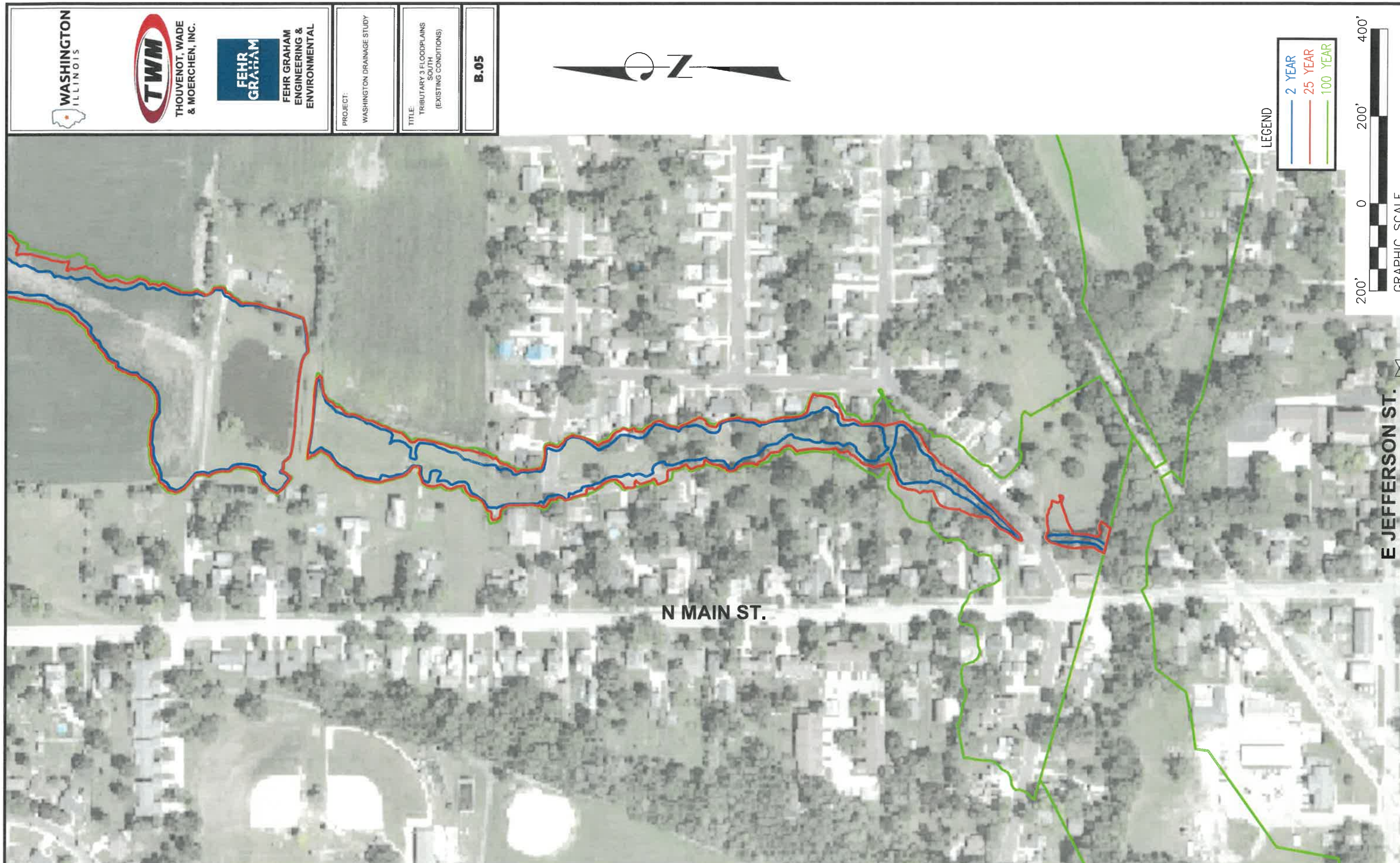

WASHINGTON
ILLINOIS
TWM
THOUVENOT, WADE & MOERCHEN, INC.
FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL
PROJECT:
WASHINGTON DRAINAGE STUDY
TITLE:
TRIBUTARY 3 FLOODPLAINS NORTH (EXISTING CONDITIONS)
B.04
N
LEGEND
2 YEAR
25 YEAR
100 YEAR
200'
0
200'
400'
GRAPHIC SCALE
N MAIN ST.
EASY ST.



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WASHINGTON
ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
SOUTH TRIBUTARY FLOODPLAINS (EXISTING CONDITIONS)

B.06

N

LEGEND
- 2 YEAR
- 25 YEAR
- 100 YEAR

400' 0 400' 800'
GRAPHIC SCALE

WASHINGTON
ILLINOIS

Appendix C

Proposed Inundation Maps

WASHINGTON
ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION
2-YEAR NORTH
(PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.01

WASHINGTON ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION
2-YEAR SOUTH
(PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.02

WASHINGTON
ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION
25-YEAR NORTH
(PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.03

WASHINGTON
ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION
25-YEAR SOUTH
(PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.04

WASHINGTON ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION 100-YEAR NORTH (PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.05

WASHINGTON
ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 1 DETENTION 100-YEAR SOUTH (PROPOSED CONDITIONS PER PROJECTS REG. A & REG. B)

C.06

WASHINGTON ILLINOIS

THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: TRIBUTARY 2 DETENTION 2-YEAR NORTH (PROPOSED CONDITIONS PER PROJECT REG. C)

C.07

WASHINGTON ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 2 DETENTION
2-YEAR SOUTH
(PROPOSED CONDITIONS PER PROJECT REG. C)

C.08

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WASHINGTON
ILLINOIS

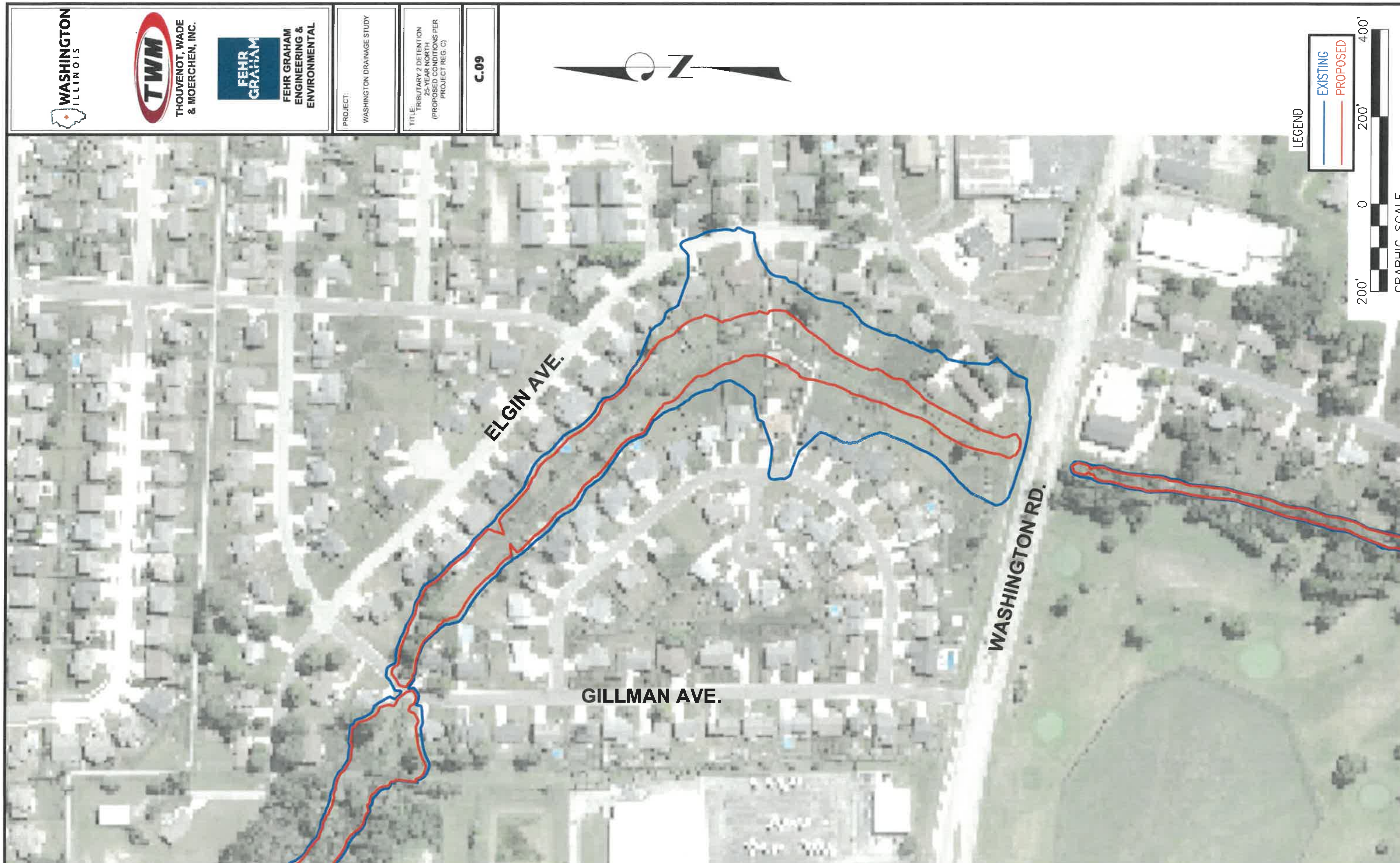
TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 2 DETENTION 25-YEAR NORTH (PROPOSED CONDITIONS PER PROJECT REG. C)

C.09



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WASHINGTON
ILLINOIS

TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
TRIBUTARY 2 DETENTION
25-YEAR SOUTH
(PROPOSED CONDITIONS PER PROJECT REG. C)

C.10

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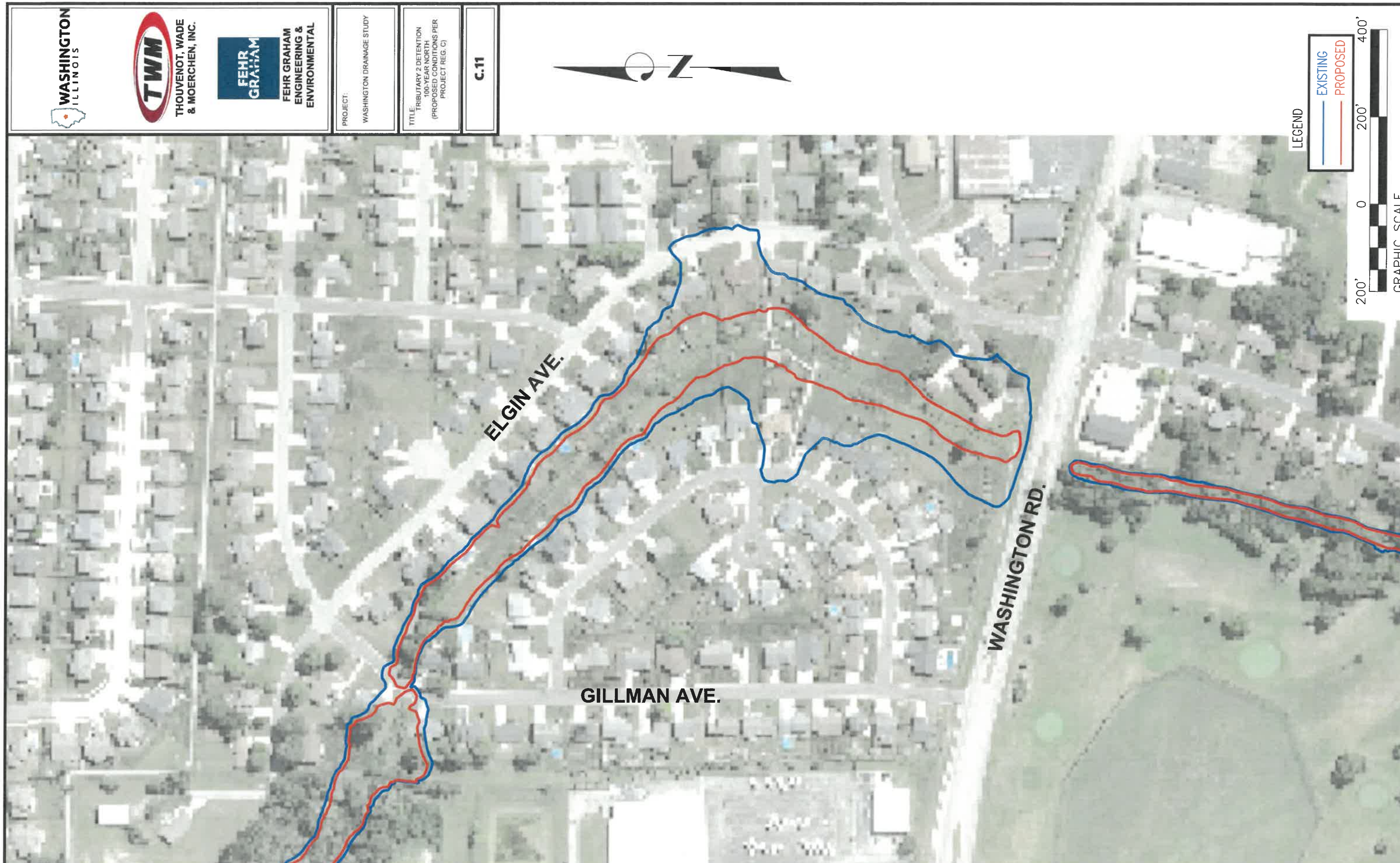
WASHINGTON
ILLINOIS
TWM
THOUVENOT, WADE & MOERCHEN, INC.
FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL
PROJECT:
WASHINGTON DRAINAGE STUDY
TITLE:
TRIBUTARY 2 DETENTION 100-YEAR NORTH (PROPOSED CONDITIONS PER PROJECT REG. C)
C.11
N
LEGEND
EXISTING
PROPOSED
GRAPHIC SCALE
200'
0
200'
400'
ELGIN AVE.
GILLMAN AVE.
WASHINGTON RD.

WASHINGTON ILLINOIS

TWM THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: TRIBUTARY 2 DETENTION 100-YEAR SOUTH (PROPOSED CONDITIONS PER PROJECT REG. C)

C.12

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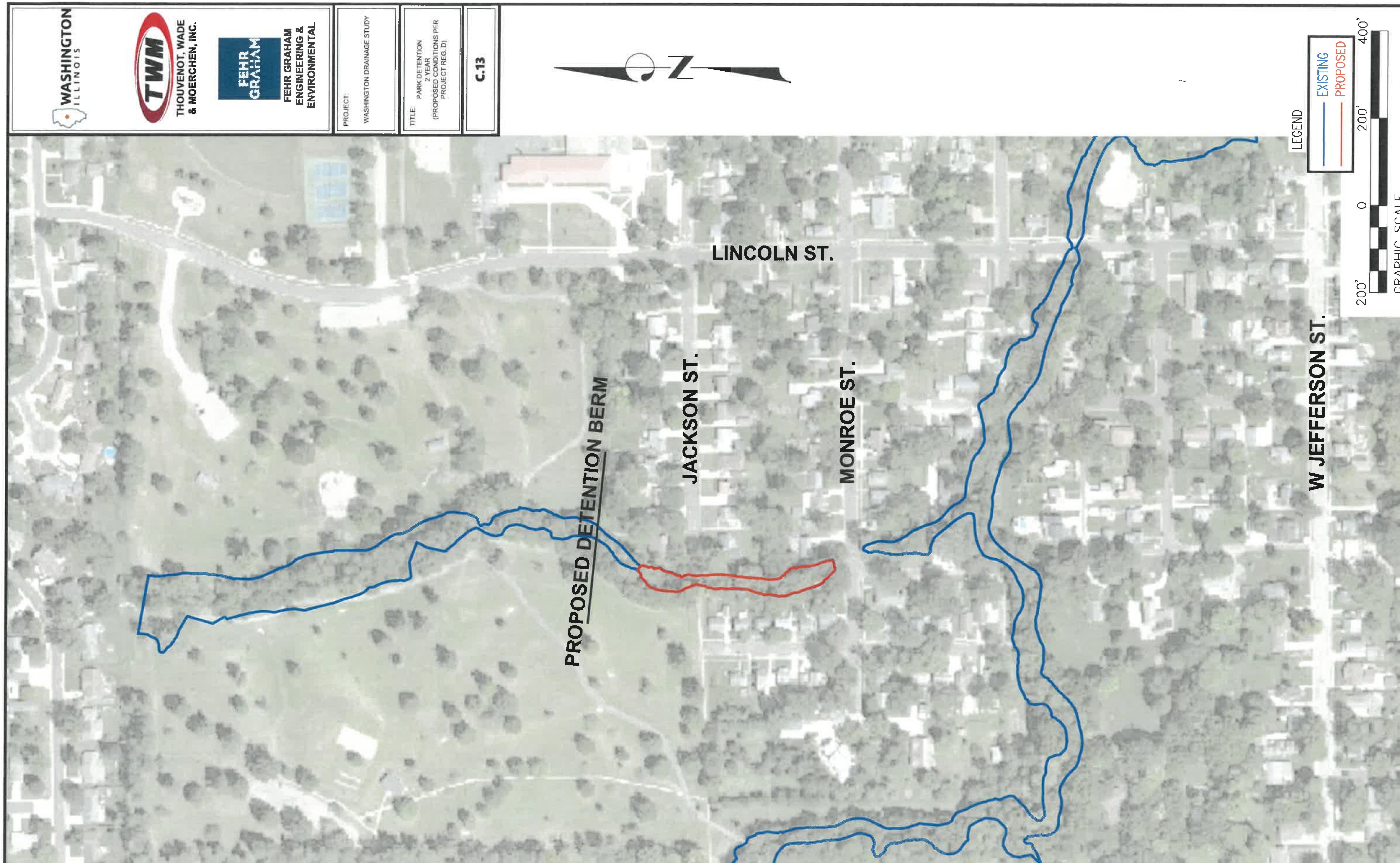
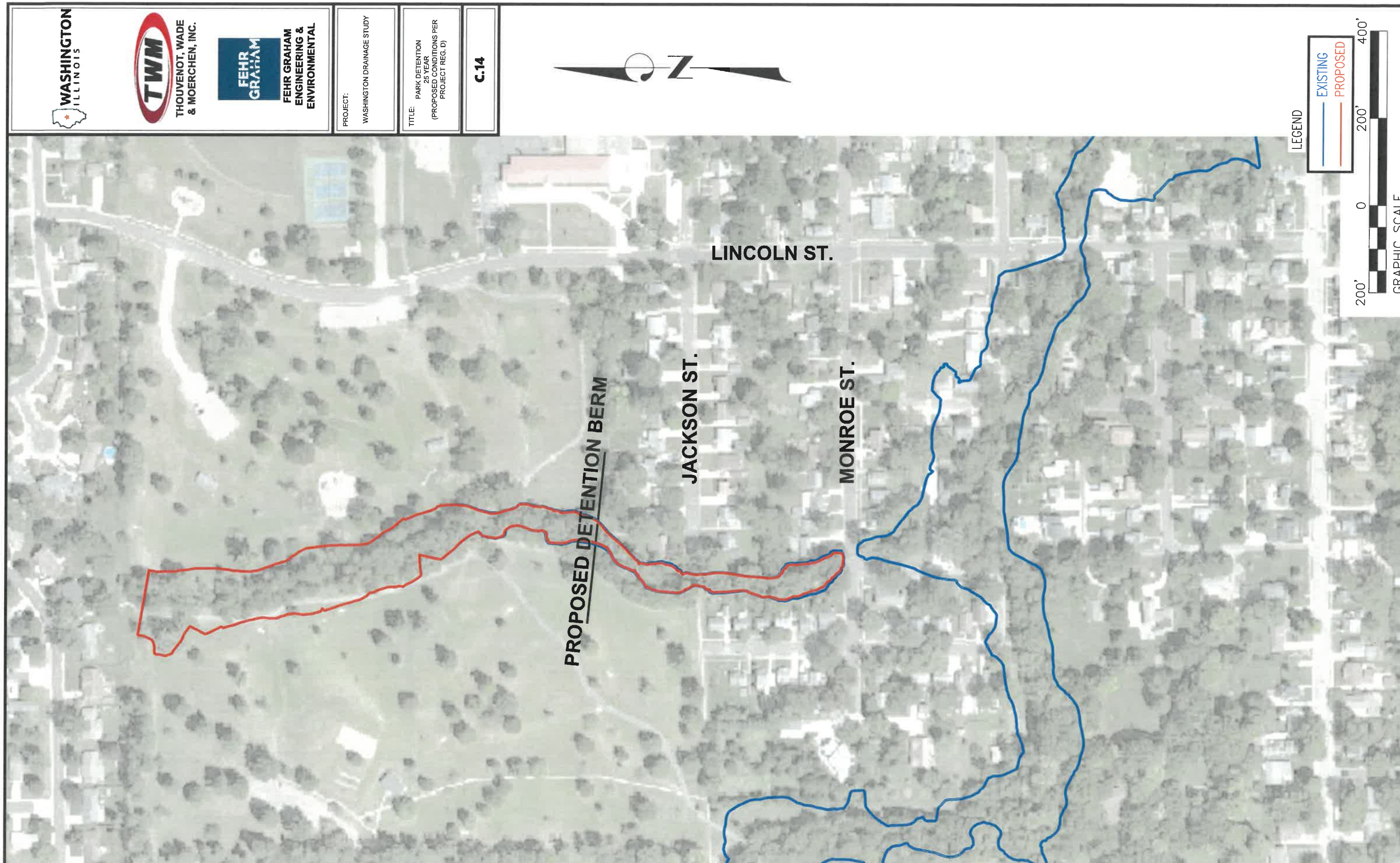

WASHINGTON
ILLINOIS
TWM
THOUVENOT, WADE & MOERCHEN, INC.
FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL
PROJECT:
WASHINGTON DRAINAGE STUDY
TITLE:
PARK DETENTION
2 YEAR
(PROPOSED CONDITIONS PER PROJECT REG. D)
C.13
N
LEGEND
EXISTING
PROPOSED
200'
0
200'
400'
GRAPHIC SCALE
LINCOLN ST.
JACKSON ST.
MONROE ST.
W JEFFERSON ST.
PROPOSED DETENTION BERM



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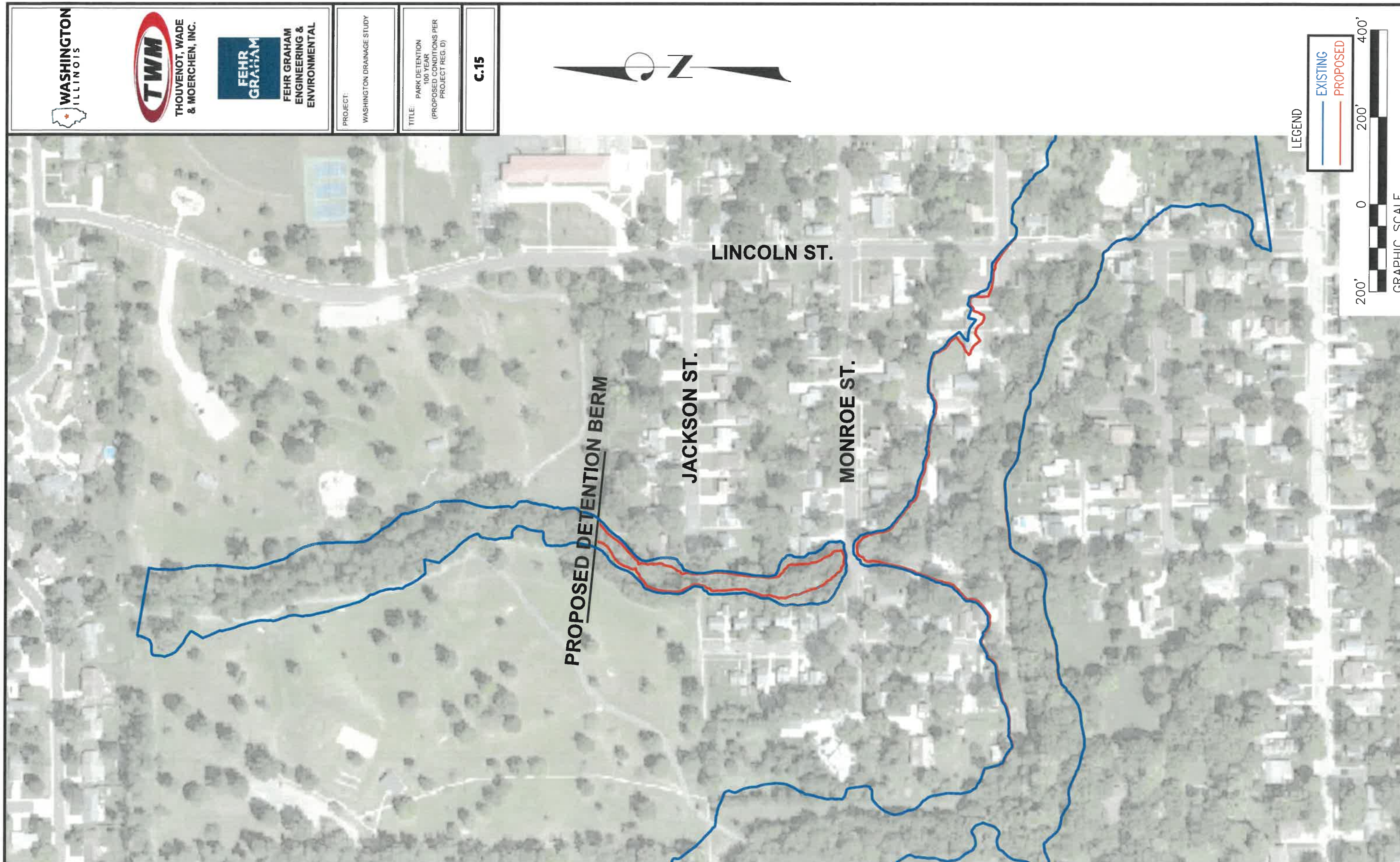

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WASHINGTON ILLINOIS

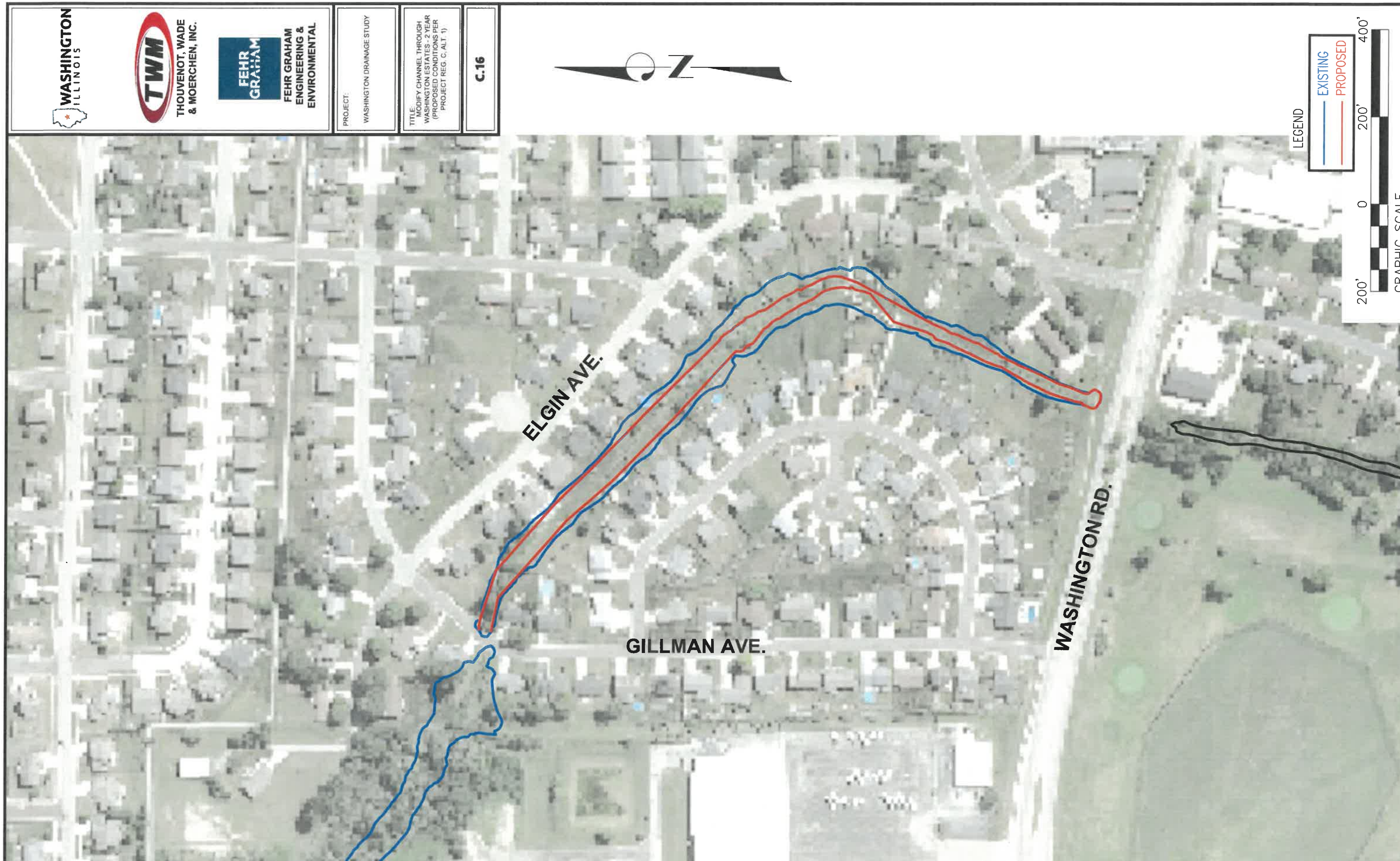
TWM THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: MODIFY CHANNEL THROUGH WASHINGTON ESTATES - 2 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT. 1)

C.16



WASHINGTON
ILLINOIS

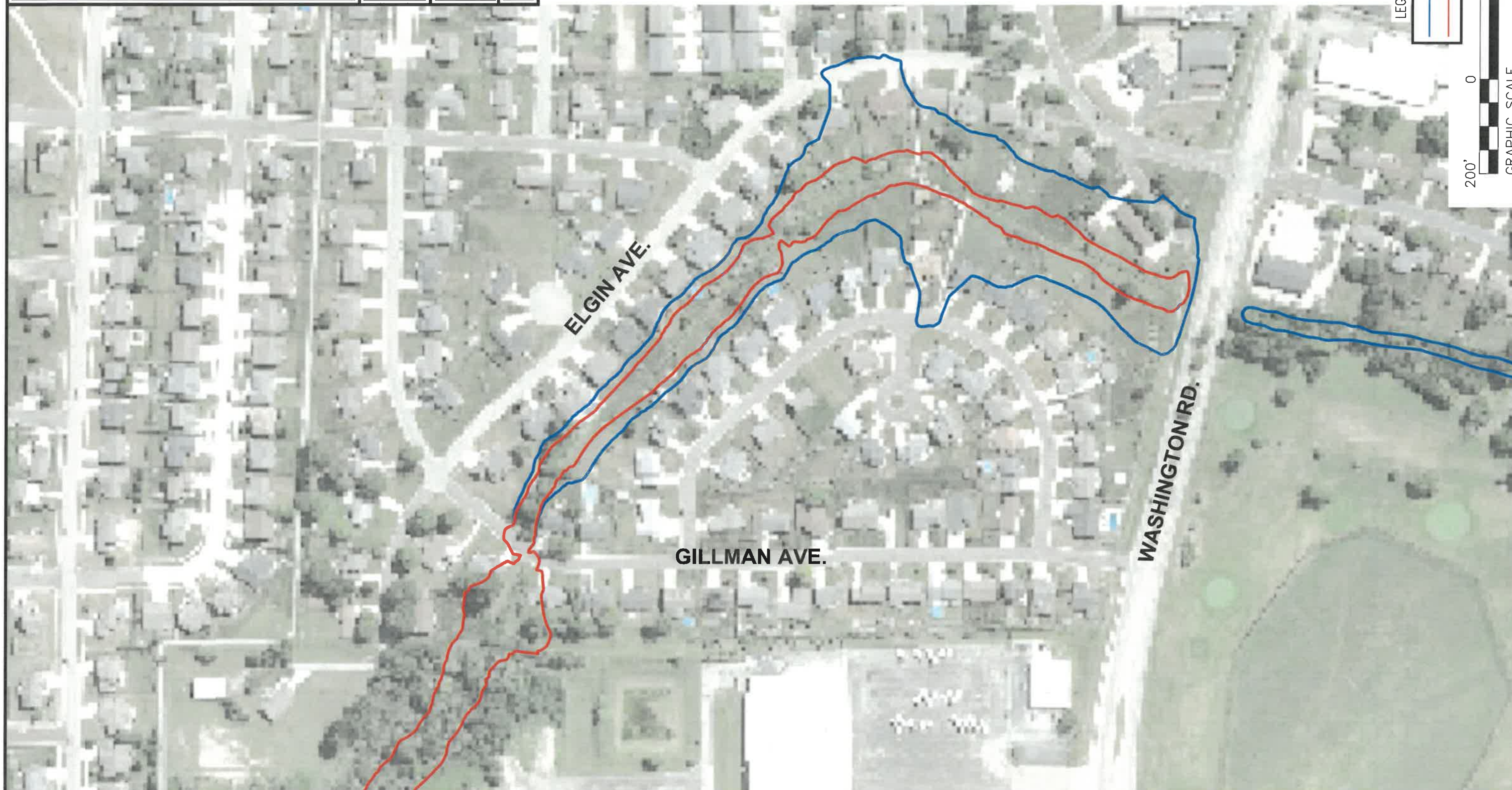
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
MODIFY CHANNEL THROUGH WASHINGTON ESTATES - 25 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT. 1)

C.17



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WASHINGTON
ILLINOIS

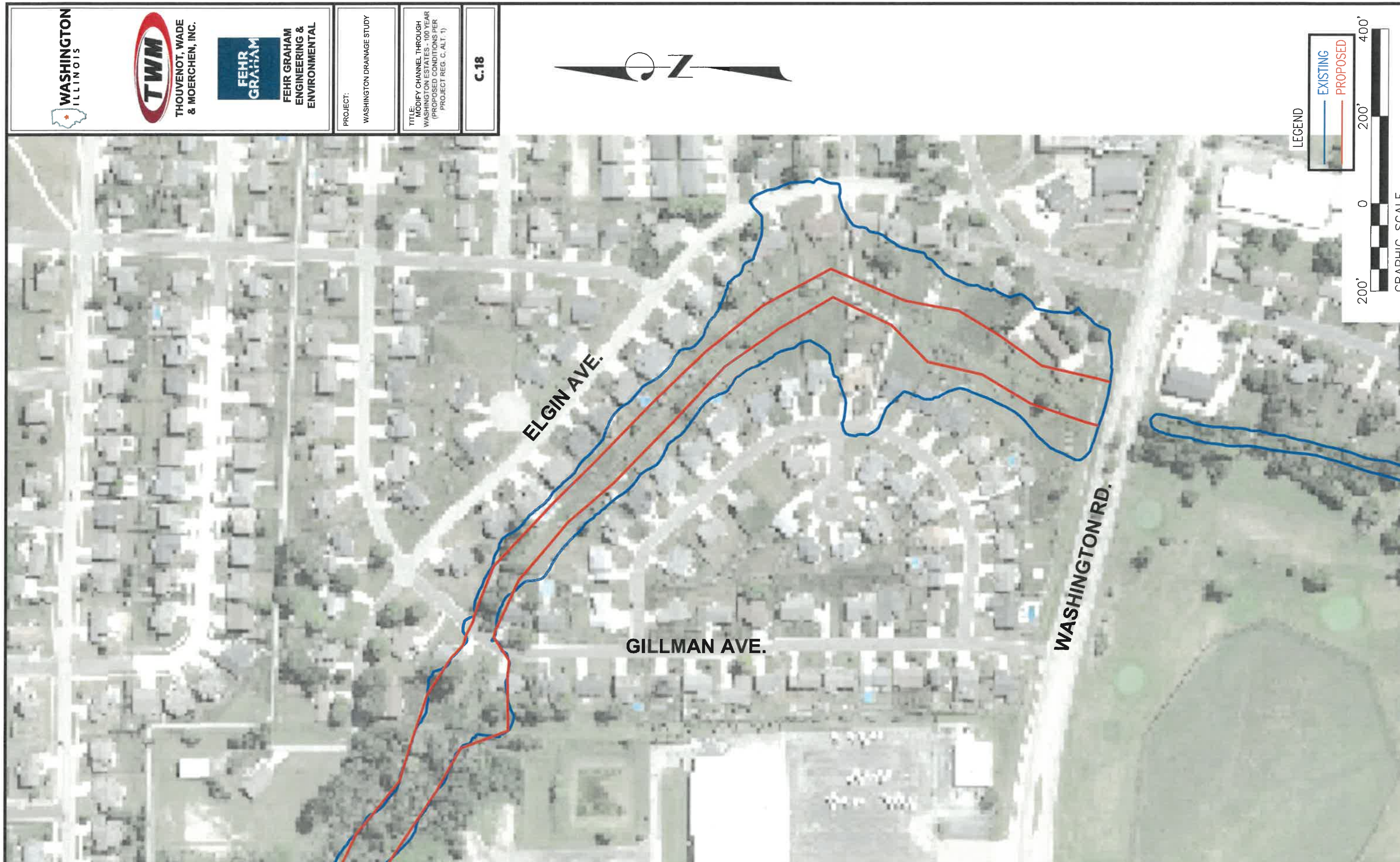
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
MODIFY CHANNEL THROUGH WASHINGTON ESTATES - 100 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT. 1)

C.18



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WASHINGTON ILLINOIS

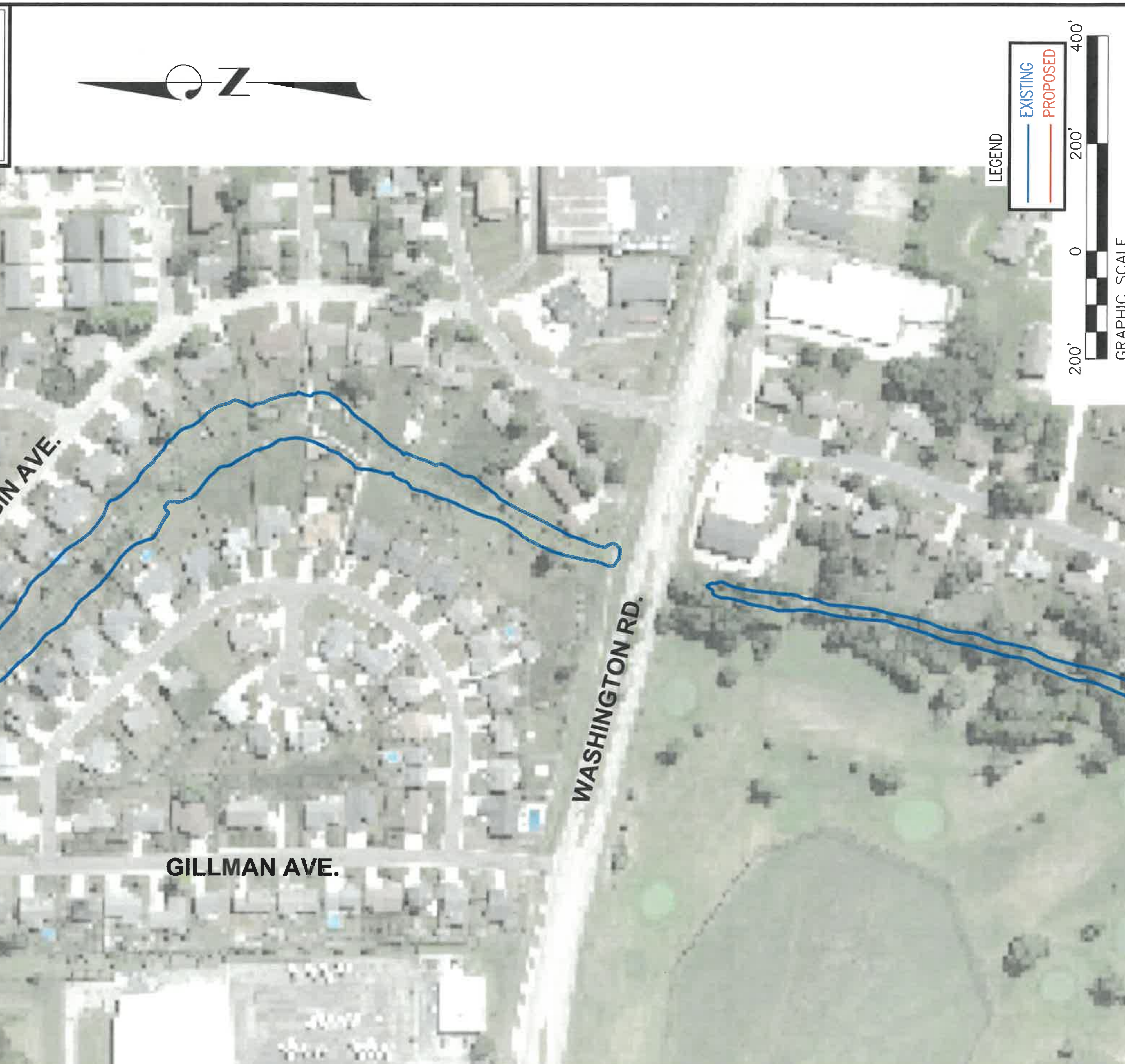
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: ENLARGE WASHINGTON ROAD CULVERT - 2 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT. 2)

C.19



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WASHINGTON
ILLINOIS

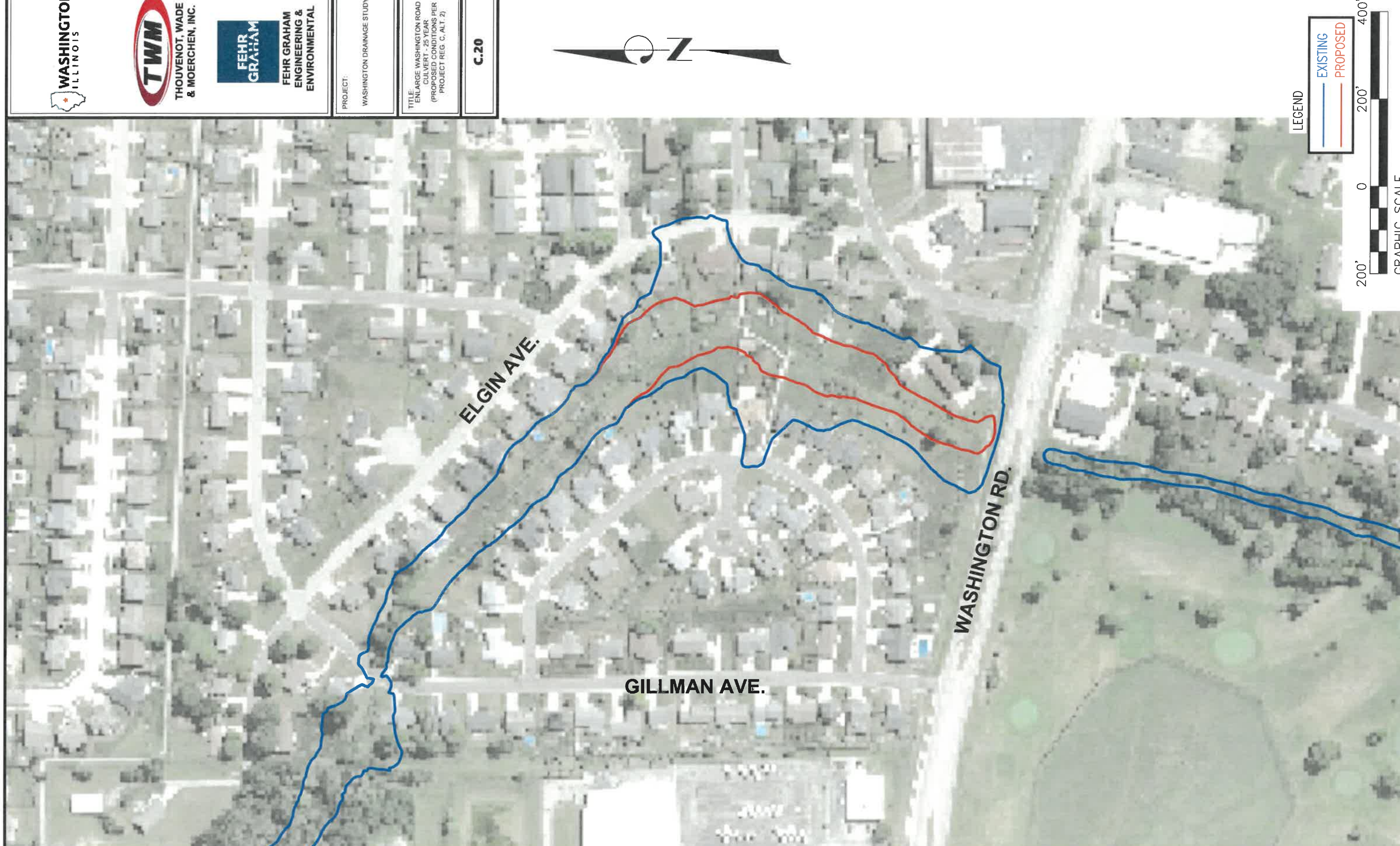
TWM
THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM
FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT:
WASHINGTON DRAINAGE STUDY

TITLE:
ENLARGE WASHINGTON ROAD CULVERT - 25 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT. 2)

C.20



WASHINGTON ILLINOIS

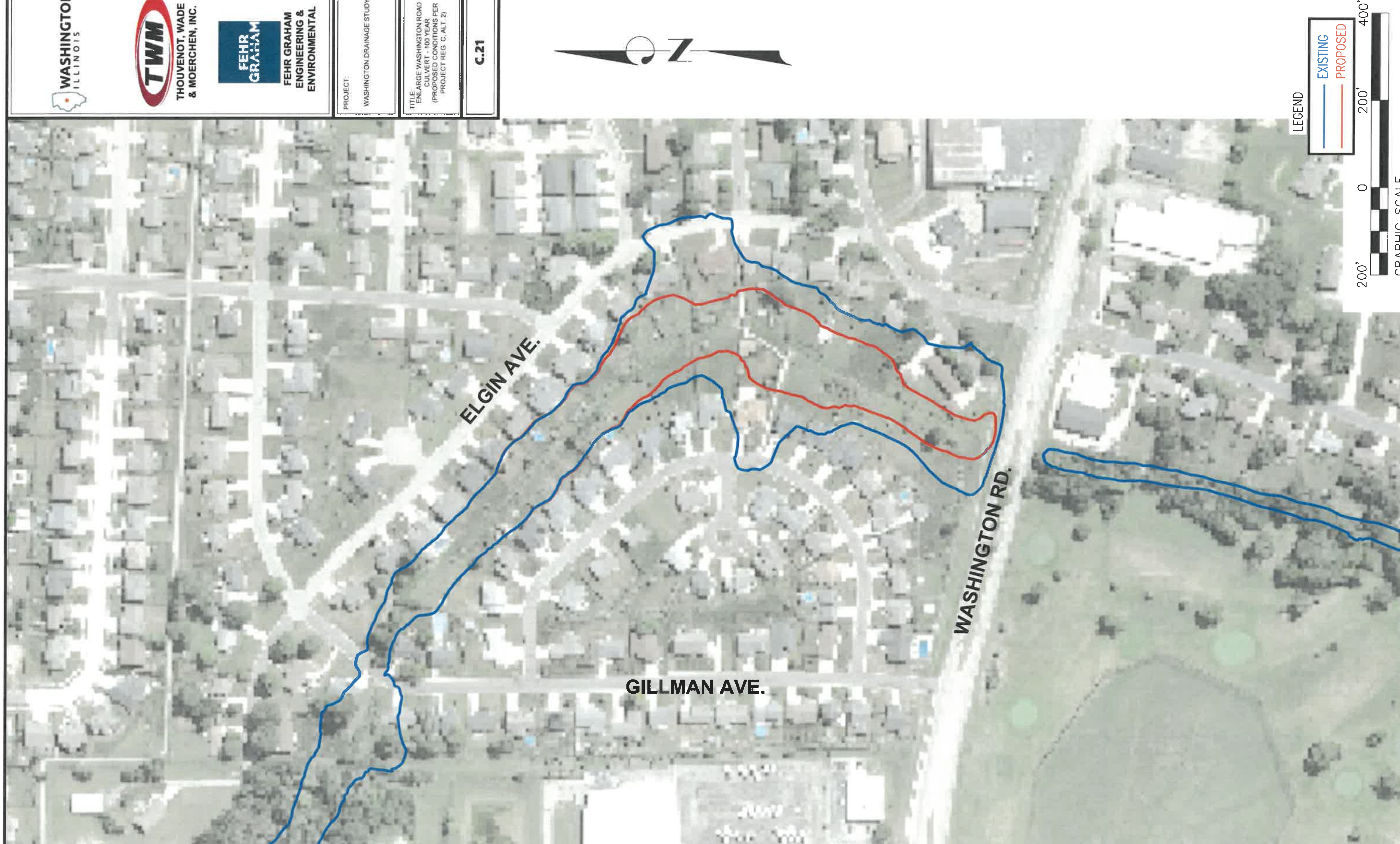
TWM THOUVENOT, WADE & MOERCHEN, INC.

FEHR GRAHAM ENGINEERING & ENVIRONMENTAL

PROJECT: WASHINGTON DRAINAGE STUDY

TITLE: ENLARGE WASHINGTON ROAD CULVERT - 100 YEAR (PROPOSED CONDITIONS PER PROJECT REG. C, ALT 2)

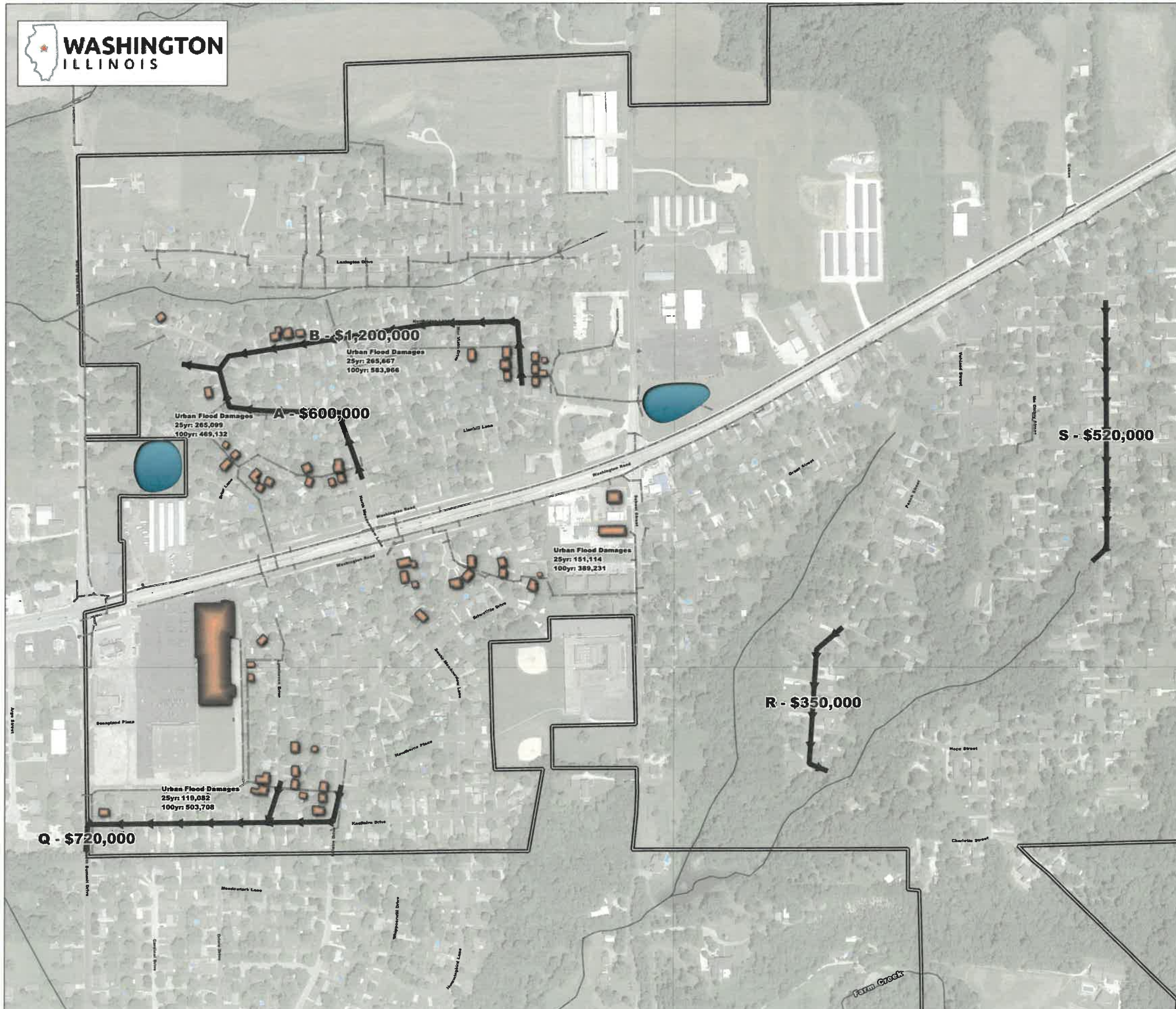
C.21



WASHINGTON
ILLINOIS

Appendix D

Urban Flooding Inundation Maps and Project Cost Estimates



Projects

Western Washington

Project A:
Diverting stormwater along Meadowview Lane with proposed 24" and 36" storm sewers. Reroutes storm sewer along roadway and diverts water from system coming from Washington Road. A new basin located behind an industrial property and next to the street could provide offsetting flow attenuation.

Project B:
Diverting stormwater from backyards to Northridge Lane. Proposed 36" and 48" storm sewer are routed along roadways and combine with Project A discharges as it discharges to the creek to the west. An expansion of the existing basin located at Washington Road and School Street will reduce flows to this system.

Project Q:
Diverting flows away from backyards to Knollair drive with 36" storm sewers.

Project R:
Increasing capacity of drainage system by installing storm sewers along Peach Street. Currently drains with ditches and driveway culverts.

Project S:
Increasing capacity of drainage system by isntalling storm sewers along Wagner Street. Currently drains with ditches and driveway culverts.

Map Key

Linear Projects
- Proposed Ditch
- Proposed Storm Sewer
- Proposed Storage Basins
- Streambank Stabilization
- Urban Flood Impacts
- Floodplain Impacts

Exhibit Information

Washington Storm Sewer Study
Project No.: 21-906
Date: April 22, 2022
Prepared By: J. Macke

N
0 400 800 ft

Reference
Imagery: Google Satellite Imagery
Topography: Illinois LiDAR clearinghous
Subbasins: Produced with SAGA GIS
Flooding: Produced with PC SWMM
Mapping: Created with QGIS

TWM

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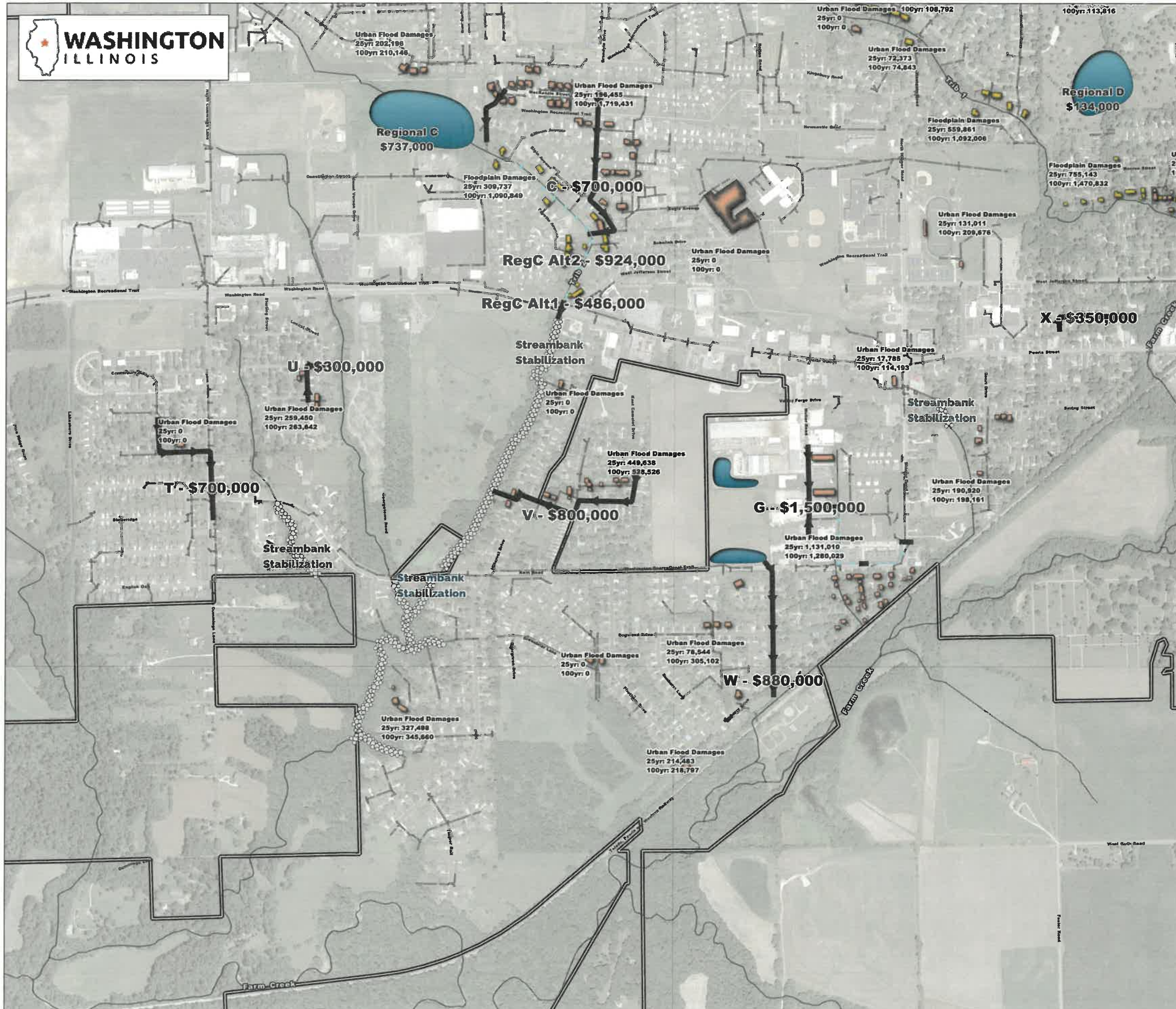


Projects

Central Washington

Project C:
Adding relief storm sewer for neighborhood drainage along Grandyle Drive. Storm sewers are 36" and 48" along route to the creek in the south. Challenging outfall location with the need to construct pipe between homes.

Project T:
Storm sewers from Brookshire Drive to Kern Road will alleviate system surcharging.

Project U:
Rural street sections are unable to convey all flows from the neighborhood along Locust Street. Proposed storm sewer adds capacity to alleviate flooding.

Project V:
Rerouting storm sewers along roadways and adding capacity near Parkview Drive and Greenfield Drive.

Project G:
Upstream storage basin near industrial properties attenuates flows before being collected in upsized storm sewer system along Muller Road. Increasing ditch capacity and culverts en route to Kern Road to avoid allowing water to overtop and flood neighborhood to the south.

Project W:
Adding storage basin north of Kern Road and relief storm sewer along Woodland Trail to reduce overflows in neighborhood south of Kern Road and west of Woodland Trail.

Project X:
Adding storm sewer along Tiezzi Lane and Michael Court to provide drainage along undrained urban corridor.

Regional C:
Detention pond west of Elgin Avenue and south of Kingsbury Road. Reduces flows to Trib 2 to limit the impact of overbank flooding towards homes. Alternatively, channel grading or replacement of the Washington Road culvert could provide similar benefits.

Regional D:
Creation of a storage area within Washington Park. Reduces flows to Trib 1 and Farm Creek downstream flooded areas.

Map Key

Linear Projects
- Proposed Ditch
- Proposed Storm Sewer
- Proposed Storage Basins
- Streambank Stabilization
- Urban Flood Impacts
- Floodplain Impacts

Exhibit Information

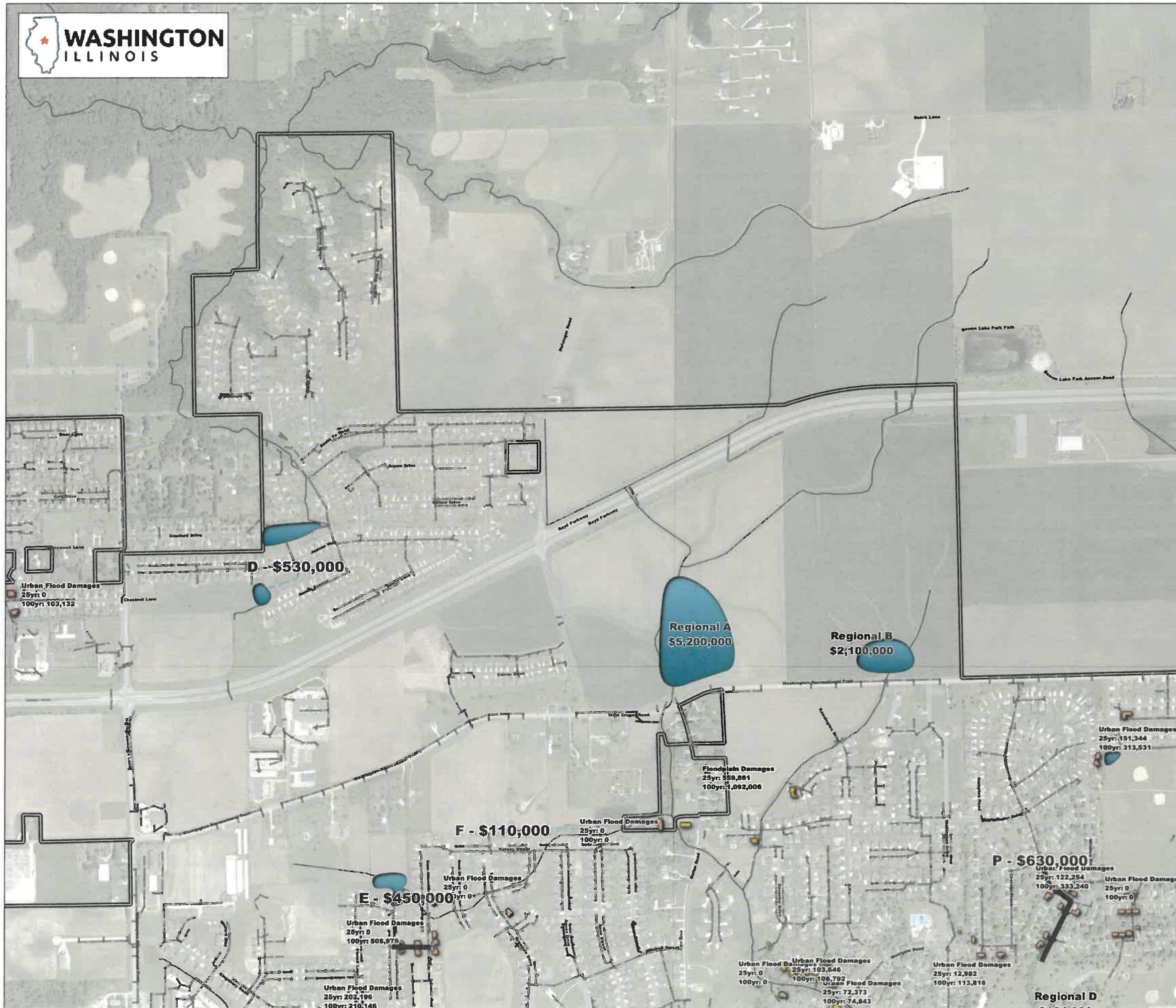
Washington Storm Sewer Study
Project No.: 21-906
Date: April 22, 2022
Prepared By: J. Macke

N
0 400 800 ft

Reference
Imagery: Google Satellite Imagery
Topography: Illinois LiDAR clearinghous
Subbasins: Produced with SAGA GIS
Flooding: Produced with PC SWMM
Mapping: Created with QGIS

TWM

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL



Projects

Northern Washington

Project D:
Expanding detention basin north of Jadens Way. Creation of additional storage basin along Austin Avenue and ditch grading. Project will limit ditch overflows from impacting properties along Jadens Way and Austin Avenue.

Project E:
Expanding detention basin west of Patricia Street to mitigate flows entering neighborhood system. Reconfigured basin will lower high water elevation to reduce flooding to upstream storm system.

Project F:
Regrading ditch north of Kelsey Street properties to reduce backyard and property flooding.

Project P:
Upsizing storm sewers from Cambridge Drive to Washington Park. Large upstream drainage area overwhelms system at the downstream end, flooding nearby properties.

Project O:
Increasing storm sewer capacity from Wilshire Drive to Washington Park ditch outfall.

Project N:
Adding relief storm sewer underneath recreational path to prevent system overflows near Monroe Street and North Main Street.

Regional A:
Large scale detention basin north of Cruger Road to reduce flows to Trib 1. Design should be coordinated with future development. Retain at least 100-year storm event to pre development flows for new development.

Regional B:
Large scale detention basin north of Cruger Road to reduce flows to Trib 1. Design should be coordinated with future development. Retain at least 100-year storm event to pre development flows for new development.

Map Key

Linear Projects
- Proposed Ditch
- Proposed Storm Sewer
- Proposed Storage Basins
- Streambank Stabilization
- Urban Flood Impacts
- Floodplain Impacts

Exhibit Information

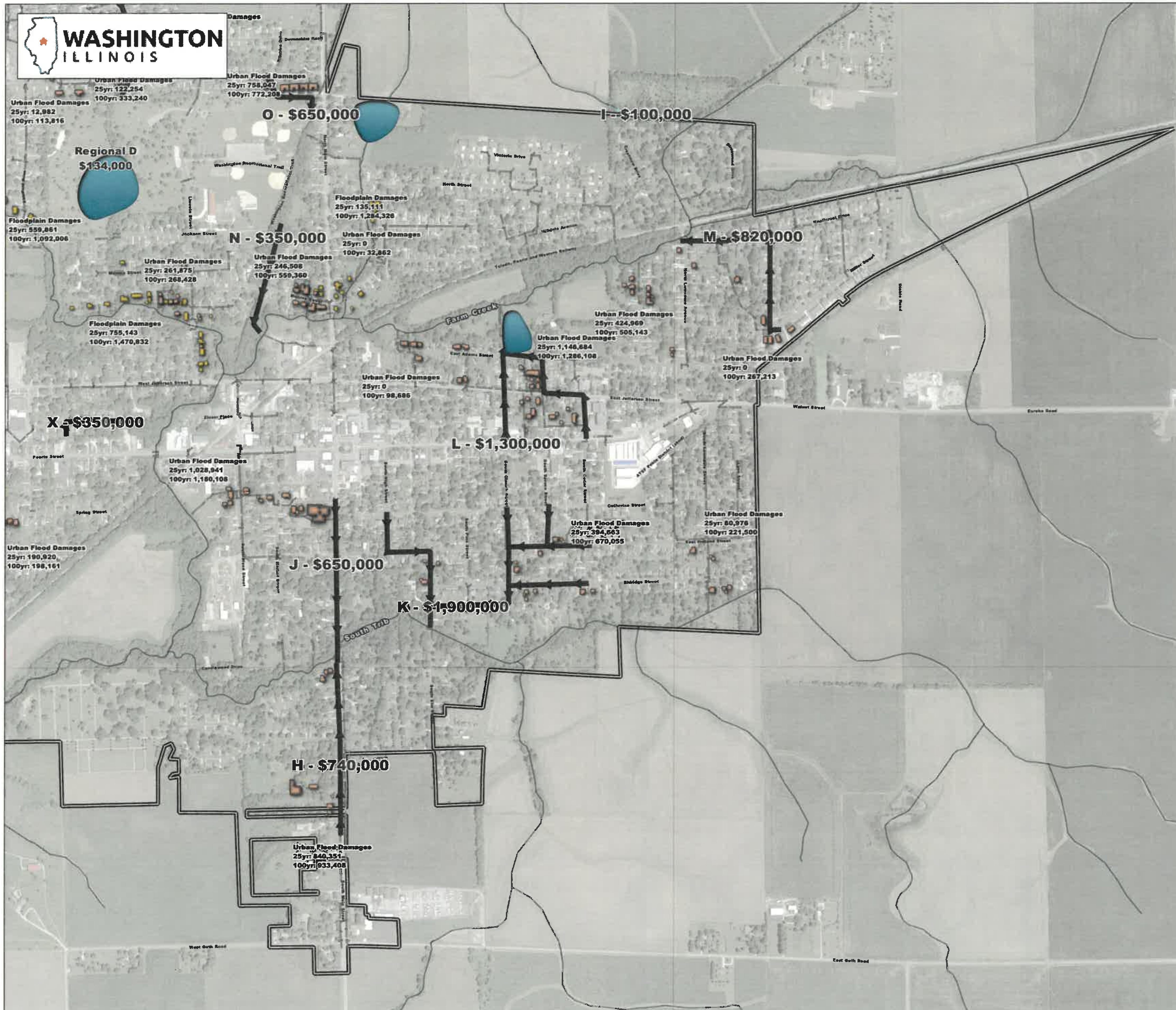
Washington Storm Sewer Study
Project No.: 21-906
Date: April 22, 2022
Prepared By: J. Macke

N
0 400 800 ft

Reference
Imagery: Google Satellite Imagery
Topography: Illinois LiDAR clearinghous
Subbasins: Produced with SAGA GIS
Flooding: Produced with PC SWMM
Mapping: Created with QGIS

TWM

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL



Projects

Eastern Washington

Project I:

Ditch regrading north of properties along Crestview Drive. Limits the overtopping of ditch and flow through properties towards Crestview Drive.

Project J:

Increasing storm sewer capacity along South Main Street while connecting to inlets at Burton Street to alleviate system pressure to the northwest.

Project H:

Increasing capacity along South Main Street south of Farm Creek S Branch. Unknown pipe sizes in this location, so confirmation of existing capacity should be completed before moving to design.

Project K:

Increasing capacity of storm systems from South High Street to South Cedar Street on the south side of downtown. Proposed roadway work on Catherine Street will improve inlet capacity. Project K will add storm sewers to tie into new drainage on Catherine Street.

Project L:

Dual storm sewers replace existing network to allevate overflows that start at Walnut Street and flow towards Adams Street.

Project M:

Diverting stormwater from Miller Street and Brookcrest to Farm Creek. New storm sewer will be installed under Brookcrest and then run west along Knollcrest to Farm Creek.

Map Key

Linear Projects

- Proposed Ditch
- Proposed Storm Sewer
- Proposed Storage Basins
- Streambank Stabilization
- Urban Flood Impacts
- Floodplain Impacts

Exhibit Information

Washington Storm Sewer Study
Project No.: 21-906
Date: April 22, 2022
Prepared By: J. Macke

N

0 400 800 ft

Reference
Imagery: Google Satellite Imagery
Topography: Illinois LiDAR clearinghouse
Subbasins: Produced with SAGA GIS
Flooding: Produced with PC SWMM
Mapping: Created with QGIS

TWM

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Potential Improvement Projects

Cost Estimates

Project Name	Description	Cost ($)
A	Meadowview Lane storm sewer	$600,000
Reg. A	Regional detention pond north of Cruger Road	$5,200,000
B	Northridge Lane backyard storm sewer trunk line	$1,200,000
Reg. B	Regional detention pond north of Cruger Road	$2,100,000
C	Grandyle Drive relief storm sewer	$700,000
Rec. C	Regional detention pond west of Elgin Avenue	$737,000
Reg. C, Alt. 1	Channelized excavation in Washington Estates	$924,000
Reg. C, Alt. 2	Enlarged Washington Road culvert near Washington Estates	$486,000
D	Enlarged Jadens Way detention basin	$530,000
Reg. D	Regional detention pond in Washington Park	$134,000
E	Enlarged Patricia Street detention basin	$450,000
F	Kelsey Street berm reconstruction	$110,000
G	Muller Road storm sewer and storage basin	$1,500,000
H	South Main Street storm sewer at Farm Creek	$740,000
I	Crestview Drive ditch regrading	$100,000
J	South Main Street and Burton Street storm sewer	$650,000
K	South High Street and South Cedar Street storm sewer	$1,900,000
L	Walnut Street and Adams Street storm sewer	$1,300,000
M	Miller Street and Brookcrest storm sewer	$820,000
N	Monroe Street and North Main Street storm sewer	$350,000
O	Wilshire Drive to Washington Park storm sewer	$650,000
P	Cambridge Drive to Washington Park storm sewer	$630,000
Q	Knollair storm sewer	$720,000
R	Peach Street storm sewer	$350,000
S	Wagner Street storm sewer	$520,000
T	Brookshire Drive and Kern Road storm sewers	$700,000
U	Locust Street storm sewer	$300,000
V	Parkview Drive and Greenfield Drive storm sewer	$800,000
W	Kern Road storage basin and Woodland Trail storm sewer	$880,000
X	Tiezzi Lane and Michael Court storm sewer	$350,000

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