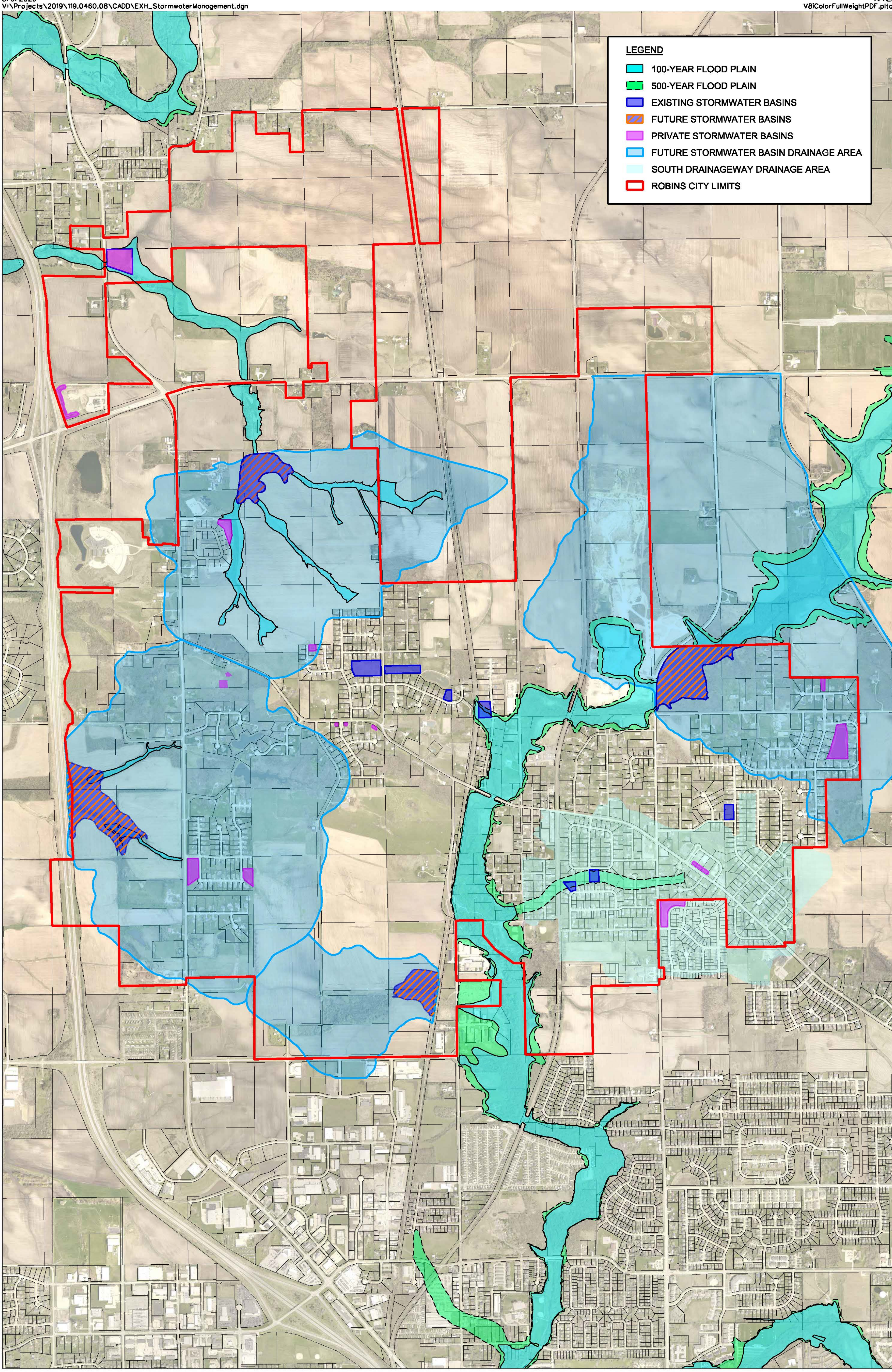
APPENDIX B
STORMWATER MANAGEMENT

EXHIBIT 1
STORMWATER MANAGEMENT

2020 SFGO STORMWATER MANAGEMENT MAP



SNYDER & ASSOCIATES

Stormwater Management

SFGO Infrastructure Inventory | Robins, IA | 03/24/2020

EXHIBIT 2
STORMWATER MANAGEMENT

2014 ZEISER PROPERTY WATERSHED MANAGEMENT PLAN

WATERSHED MANAGEMENT PLAN – ZIESER PROPERTIES
CITY OF ROBINS, IOWA
PROJECT NO. 114.0405.08

JANUARY 16, 2015

I hereby certify that this Engineering Document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Iowa.

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Kyle D. Riley, P.E. Date

License Number 20550

My License Renewal Date is December 31, 2016

Pages or sheets covered by this Seal:

All Pages

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-Public Meeting PowerPoint Presentation

1. INTRODUCTION

1.1. Project Location

The City of Robins, herein referred to as "the City," is located in the central west portion of Linn County, Iowa. The City is approximately 5.9 square miles and a vicinity map showing the location of the City can be found as Figure 1.3.1. The watershed being studied as a part of this Management Plan is located in the northwest portion of the City as seen on the Drainage Area Map, Figure 2.1.1, located in Section 2 of this report. The extent of the full watershed borders W. Main Street to the south and continues north to County Home Road. The drainage corridors eventually drain to Otter Creek west of Interstate 380 via an Unnamed Tributary to Otter Creek.

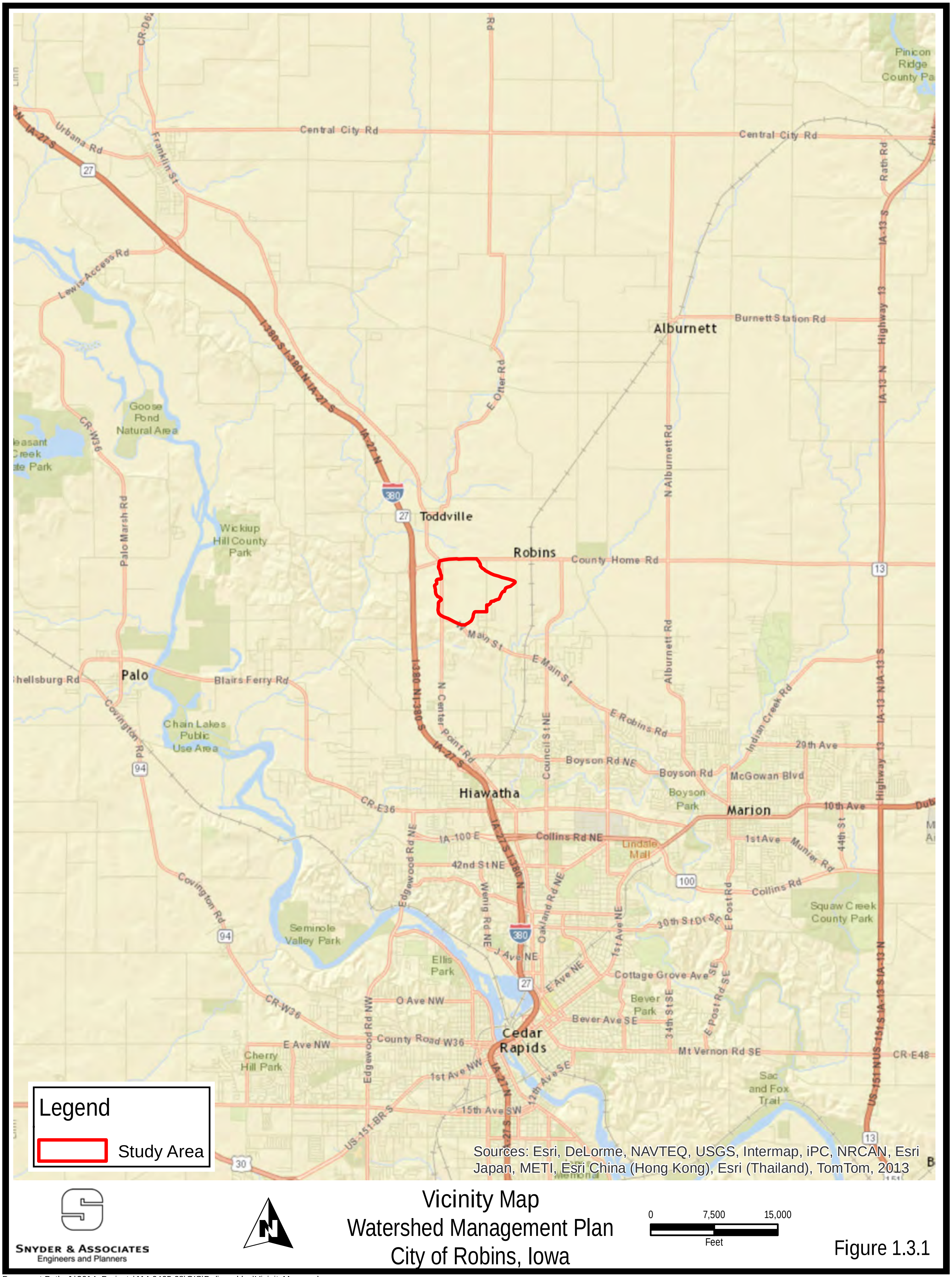
1.2. Purpose of Study

The results of this study will be used in the City's growth strategy for the Zieser Properties. The Zieser Parcels can be found in Figure 1.3.2. The study was conducted as a two pronged approach. First, the feasibility of a regional retention basin was investigated. Second, drainage corridor alternatives were investigated to determine the conveyance capacity needed if a regional retention basin was utilized for stormwater management. Prior to commencing development within the Zieser Properties, the City will use the data and information within this report to manage the development within the watershed in cooperation with the property owners and potential developers. Development within these properties must comply with the recommendations found in this report.

1.3. Study Information

The information within this study provides data, mapping, and other information regarding the watershed and stream corridors draining through the Zieser Properties. This report covers the hydrologic modeling for the watershed starting near W. Main Street and ending at County Home Road as depicted in Figure 2.1.1 located in Section 2 of this report. Hydraulic modeling of the drainage corridors was limited to approximately where waterways currently exist to the south and starting at Quass Road to the east. These corridors join into one stream that was analyzed ending at County Home Road. Please see Figure 4.1.1 in section 4 of this report for a graphical representation. The combined length of studied corridors is approximately 2 miles.

This report also includes an assessment of watershed issues and recommendations to be implemented prior to proceeding with development. Recommendations were given while being mindful of issues that may arise downstream as improvements and developments occurred within the watershed. The main element of the report will show the feasibility of a City desired regional retention basin and recommendations based on the construction and implementation of this basin. This data and information will be accompanied by an order of magnitude cost opinion to assist the City with prioritization and budgetary planning. During this watershed study, analyses were implemented based on a macro, or watershed level, approach. Because of the uniqueness of specific situations, micro level, or site specific problems were not analyzed or assessed in detail during this study.



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Vicinity Map
Watershed Management Plan
City of Robins, Iowa

Figure 1.3.1

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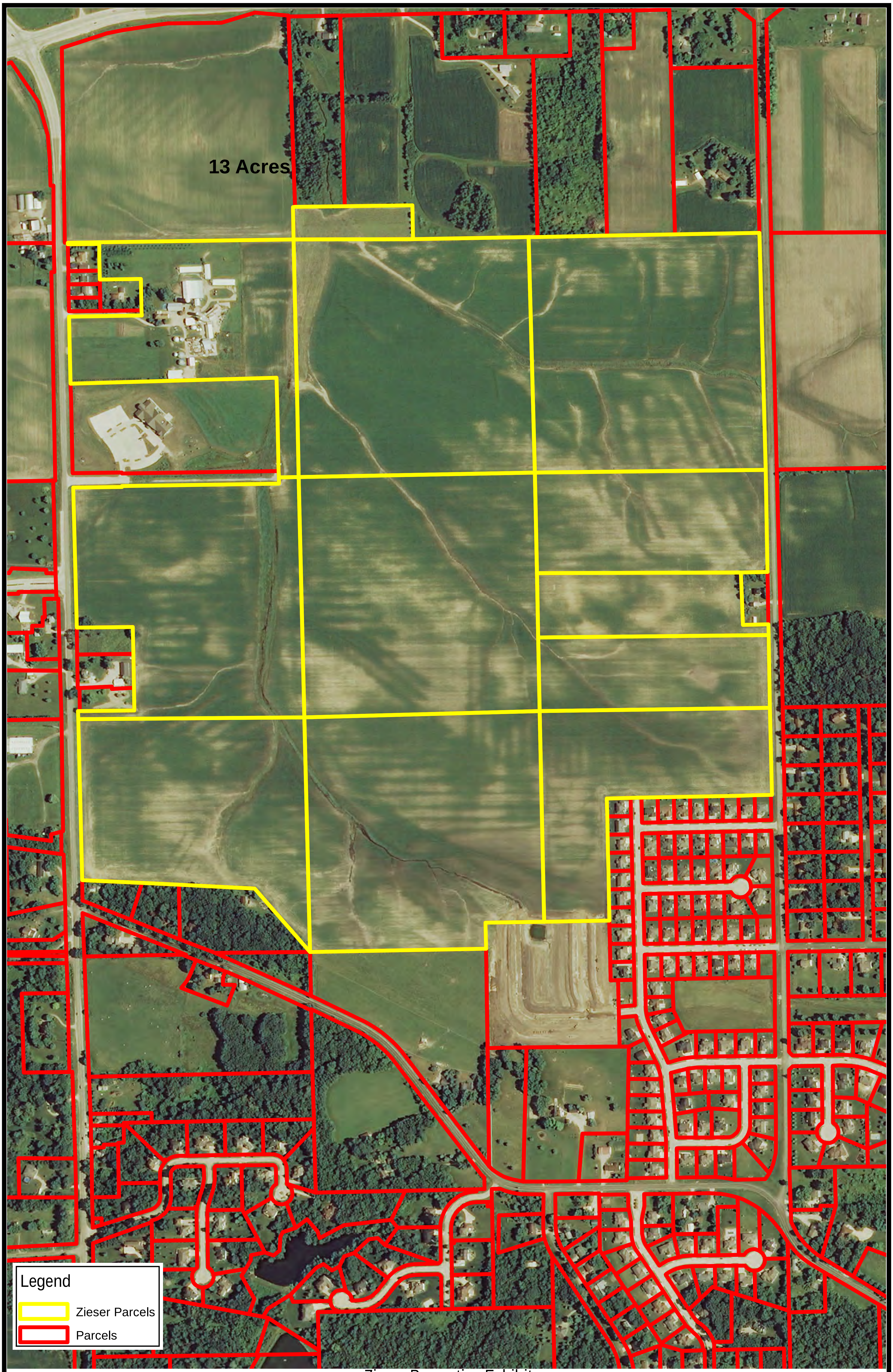

Zieser Properties Exhibit
Watershed Management Plan
Robins, Iowa

0 250 500
Feet

Figure 1.3.2

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2. HYDROLOGIC MODELING

2.1. Existing Conditions

2.1.1. Model Setup

ArcGIS was used exclusively to develop hydrologic data and to set up the initial hydrologic model. Parameters developed include drainage area delineation, longest flow paths, channel slope, and other pertinent characteristics. Iowa Statewide LiDAR topographic data and local drainage were examined to divide the watershed into 13 sub-watersheds at appropriate locations for the development of a more accurate hydrologic model. These are displayed on the Drainage Area Map presented as Figure 2.1.1 below. These sub-watersheds were connected using junctions and reaches within the PondPack software as needed. The Modified Puls method was used to route flow from an upstream basin through the next basin downstream.

2.1.2. Methodology

The hydrologic analyses were performed using Bentley's PondPack modeling software.

The 100 year (7.13 inches), 10 year (4.44 inches), 5 year (3.84 inches) and 1 year (2.40 inches), 24-hr precipitations for Linn County were Iowa Region 6 taken from Bulletin 71 – Rainfall Frequency Atlas of the Midwest, 1992. An SCS Type II Distribution for hydrograph development was used within the model.

The loss method used was the SCS CN method which is defined in the equations below. Aerial photography flown in 2013 for Linn County, Iowa was used to develop Curve Numbers (CNs) based on existing land-use in each respective sub-watershed in accordance with the Soil Conservation Service's TR-55 guidance. An initial abstraction was assumed and this value was set to 0.2S for each basin, with "S" also defined in the equations below.

$$\mathbf{Q = (P - 0.2S)^2 / (P + 0.8S)}$$
$$\mathbf{S = (1000 / CN) - 10}$$

Q = Precipitation excess (runoff) [inches]
P = Cumulative precipitation [inches]
S = Potential maximum retention [inches]
CN = SCS Curve Number

The transform method used was the SCS Unit Hydrograph method utilizing the CN Lag Method to develop the Lag parameter needed for the PondPack model. The CN Lag method equation can be found below with "S" defined previously when discussing the loss methodology.

$$\mathbf{L = I^{0.8} * (S + 1)^{0.7} / 1900 * Y^{0.5}}$$

L = Lag time [hours]
I = Watershed Hydraulic Length [feet]
Y = Average Land Slope [percent]

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Drainage Area Map
Watershed Management Plan
Robins, Iowa

0 350 700
Feet

Figure 2.1.1

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2.2. **Future Conditions**

2.2.1. **Model Setup**

Model setup is consistent with discussion presented in the existing conditions section.

2.2.2. **Methodology**

The methodology for modeling future conditions was guided by future land use plans provided to Snyder & Associates for the Zieser Properties. CNs based on future land-use in each relevant sub-watershed, in accordance with the Soil Conservation Service's TR-55 guidance, were then calculated. Initial abstraction was consistent with existing conditions modeling and was set to 0.2S for each basin. Lag values were re-calculated based on the future land use CNs.

When considering the future land use plan for the Zieser Properties, much of the watershed was assumed to be a mix of residential lots, 0.25 to 0.33 acres in size, with a proposed townhome/apartment development in the southwest portion of the watershed and a recreational park proposed in the northeast portion. A concept plan outlining the uses was put together and used as background for Exhibit A, Preliminary Floodplain and Regional Basin Elements in the Appendix of this report.

2.3. **Results**

Table 2.3.1 and Table 2.3.2 show the existing and future conditions peak inflows in Cubic Feet per Second (CFS) that reaches the site of the proposed retention basin. The future conditions peak 100-year inflows are 25% greater than existing assuming no temporary storage upstream within the proposed developments. The discharge difference is directly attributed to the increased impervious surface at the full build out conditions.

An increase in impervious surface within a watershed increases peak discharges in two ways. First, it decreases infiltration and available ponding areas. Lessening the opportunity to pond or infiltrate into the soil therefore increases total volume of runoff that reaches drainage corridors. Second, it decreases the travel time needed for stormwater runoff to reach drainage corridors. As a result there is an increased likelihood for coincident peak discharges, i.e. when peak discharges from multiple drainage corridors reach a given location at the exact same time.

Table 2.3.1: Existing Conditions Peak Inflow to Proposed Basin

Storm Event	Rainfall (in)	Existing Flow Rate (cfs)
1 Year	2.40	167
5 year	3.84	495
10 year	4.44	648
100 year	7.13	1,398

Table 2.3.2: Future Conditions Peak Inflow to Proposed Basin

Storm Event	Rainfall (in)	Future Flow Rate (cfs)
1 Year	2.40	300
5 year	3.84	713
10 year	4.44	899
100 year	7.13	1,740

3. **DETENTION ANALYSIS**

3.1. **Model Setup**

Model setup is consistent with the discussion presented in the future conditions section with the addition of retention analysis. A retention basin was added to the PondPack model in the future conditions model in order to estimate storage volume and minimum normal pool surface area requirements for the proposed regional retention basin. The approximate regional retention basin placement can be seen on Exhibit A, Preliminary Floodplain and Regional Basin Elements in the Appendix of this report.

3.2. **Methodology**

The parameters being analyzed for proper retention basin analysis are:

1. Is the contributing drainage area large enough to sustain the permanent pool?
2. What is the normal pool size needed to properly manage the water quality volume?
3. Does the normal pool calculated correlate well with the contributing drainage area to ensure sustainability?
4. How much surface area is needed for forebay sizing?
5. How much temporary storage in the regional retention basin, in addition to the permanent storage, is needed to manage multiple recurrence interval storms?
6. What multi-stage outlet structure is needed to properly manage the water quality event and multiple recurrence interval storms?

The first parameter was investigated immediately while the others are more results based and are discussed in the subsequent section. The Iowa Stormwater Management Manual (ISMM) provides guidance that a regional basin should have a minimum contributing drainage area of

100-300 acres. The contributing drainage area for the proposed regional retention basin is approximately 460 acres and therefore results based calculations could continue.

Calculation methods for the water quality analysis were taken from the ISMM. The calculations are used to best treat the runoff from 90% of the storms that occur in an average year. For Iowa, this equates to providing water quality treatment for the runoff resulting from a rainfall depth of 1.25 inches or less. The ultimate goal is to reduce sedimentation and pollutant loading downstream. The equations used to calculate the water quality volume needed for treatment can be found below.

$$\mathbf{WQv = (Rv)(A)(P)/12}$$

WQv = Water Quality Volume
Rv = site runoff volume coefficient
A = site drainage area (acres)
P = design rainfall depth (90% cumulative frequency depth) (~ 1.25 inches)

$$\mathbf{Rv = 0.05 + 0.009(I)}$$

I = % impervious area within watershed

3.3. Results

The percent impervious area for the watershed was calculated based on a future land use plan concepted by Snyder & Associates and was estimated to be 33.5% at full build out conditions. Using the equation provided in the preceding section the water quality volume is estimated to be 16.8 acre-feet (ac-ft). For example, one ac-ft is the equivalent of one foot of water depth over one acre of land area. This volume would drain from the basin within 24 – 48 hours. A summary of pertinent data can be found in Table 3.3.1 below.

Table 3.3.1: Water Quality Volume Calculation Summary

Estimated Future Impervious	Approximate Drainage Area	Approximate WQv
33.5%	460 ac	16.8 ac-ft

Once the water quality volume was calculated, an estimated normal pool for the retention basin was determined. During this process the basin surface area and water quality volume release rate were calibrated to allow for approximately a one foot increase in depth during the water quality event of 1.25 inches or less. Attention was also given to make sure the water quality volume would not be released sooner than 24 hours. Following this process, the normal pool was estimated to be 13 acres which provides a 35 to 1 ratio for the permanent pool area compared to drainage area. The ISMM provides guidance that this ratio it to be 20 to 1 or greater to ensure normal pool sustainability. A summary of data for the proposed regional retention basin can be found in Table 3.3.2 below.

Table 3.3.2: Proposed Regional Retention Basin Data Summary

Approximate Permanent Pool	Approximate Permanent Storage	Permanent Pool vs. Drainage Area
13 acres	195 ac-ft	35 to 1

Sedimentation forebay sizing is directly correlated to the water quality volume calculations presented previously. The ISMM provides guidance that the total volume required for forebay sizing is 10% of the total water quality volume. However, there are three (3) entry points for the proposed regional detention basin. Therefore, the estimated 1.68 ac-ft of volume that is required would be split up proportionately between the three drainage tributaries. An approximate location of forebay placement can be seen on Exhibit A, Preliminary Floodplain and Regional Basin Elements in the Appendix of this report.

Volumes were determined for the amount of storage needed and the type of multi-stage outlet structure that would be required to manage multiple recurrence interval storms simultaneously. These parameters were calculated with the aid of PondPack's PondMaker design tool. Several design iterations, modifying the basin shape and outlet structure elements, were completed. During these iterations, there were three specific targets that were used during design. The three targets are ensuring:

1. The water quality volume releases within a 24 – 48 hour window.
2. The release rate for the 10 year proposed condition is less than the release rate for the 1 year existing conditions.
3. The release rate for the 100 year proposed condition is less than the release rate for the 5 year existing conditions.

These targets were selected based on design guidance found in the Iowa SUDAS Design Manual and the ISMM for Overbank Flood Protection and Extreme Flood Protection.

The multi-stage outlet structure that was used for calculations was a reinforced concrete box. The structure is similar to a standard reinforced concrete box culvert, but is installed vertically rather than horizontally with a series of openings of different sizes and elevations to control flow. An orifice would be present in the side of the inlet box wall to manage the water quality event. A weir notch would also be cut in side of the inlet box to manage the lower recurrence interval storms. Larger recurrence interval storms would be managed by the inlet box top itself. A summary of the temporary storage needed at specific storm events and a summary of release rates can be found in Table 3.3.3 and 3.3.4, respectively.

Table 3.3.3: Proposed Regional Retention Basin Temporary Storage

Storm Event	Rainfall (in)	Temporary Storage Volume (ac-ft)
Water Quality	1.25	16.8
10 year	4.44	48.6
100 year	7.13	88.8

Table 3.3.4: Proposed Retention Basin Peak Discharges

Storm Event	Rainfall (in)	Pre-Development Inflow to Basin (cfs)	Post-Development Inflow to Basin (cfs)	Allowable Release (cfs)	Concepted Release (cfs)
1 Year	2.40	167	300	167	40
5 year	3.84	495	713	167	110
10 year	4.44	648	899	167	156
100 year	7.13	1,398	1740	495	480

An order of magnitude cost opinion for the construction of the proposed basin, forebays, and outlet structure can be found as Exhibit B, Engineers Preliminary Opinion of Probable Construction Costs in the Appendix of this report. The total estimated cost is approximately $2.1 million. The cost opinion provided does not include grading or improvements made to the conveyance corridors within the development itself.

4. HYDRAULIC MODELING

4.1. Model Setup

Detailed hydraulic analyses were performed with the USACE Hydraulic Engineering Center River Analysis System (HEC-RAS) computer program (Version 4.1). Geometry data for import into HEC-RAS were generated using the ArcGIS extension HEC-GeoRAS, GIS tools for support of HEC-RAS. Cross sections were placed at critical locations with additional sections added where needed for model stability. Cross section placement can be seen on the detailed hydraulic work map presented as Figure 4.1.1.

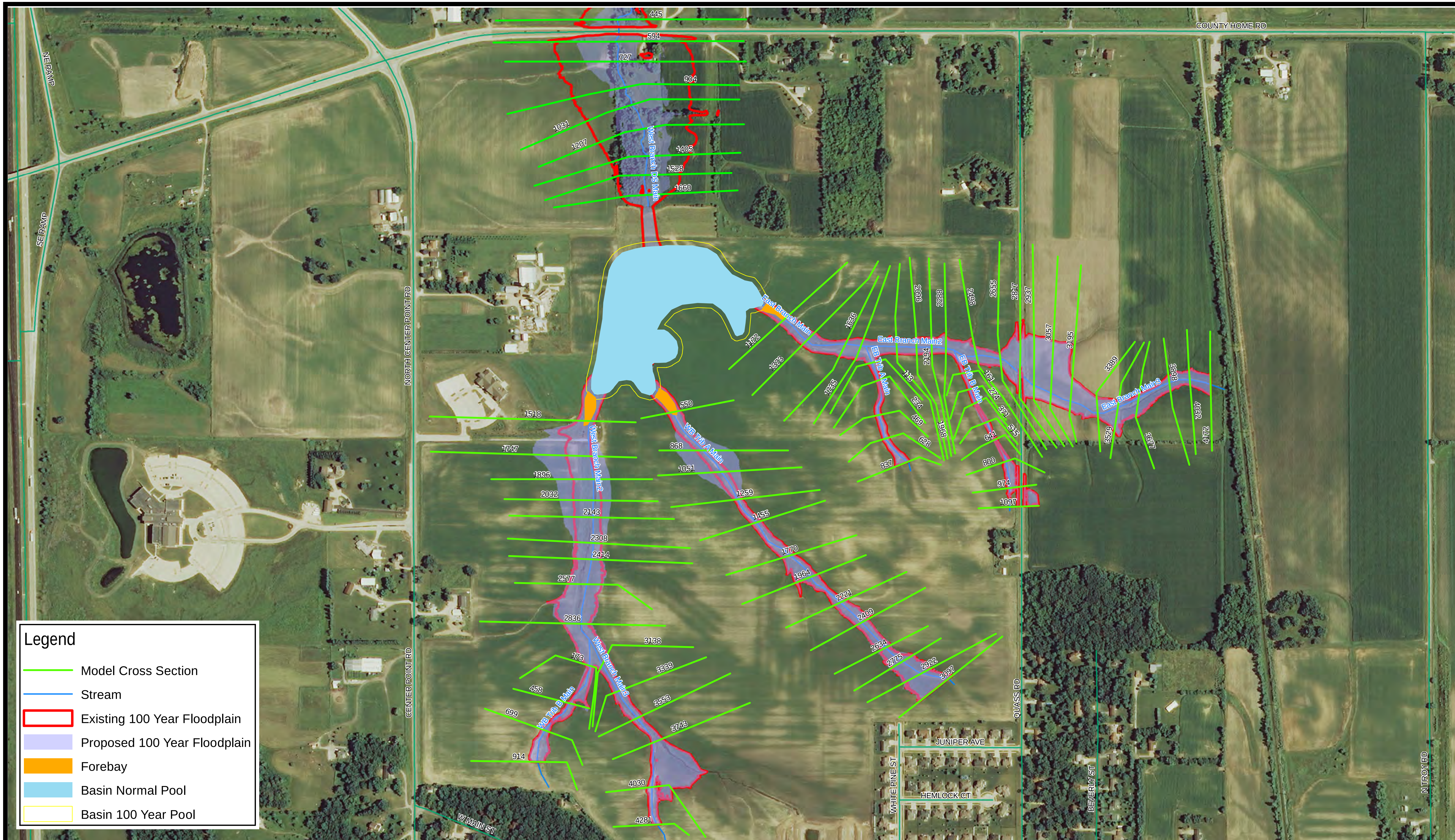
Cross section geometry was developed from field survey and Iowa Statewide LiDAR topography. Dimensions and measurements for all bridges and structures were obtained by field survey.

The data in this report and all HEC-RAS models are referenced to the North American Vertical Datum of 1988 (NAVD88). The hydraulic model is georeferenced to the North American Datum of 1983, Iowa State Plane South. Cross sections were drawn left to right looking downstream.

Overbank Manning’s “n” values were determined from field survey and color aerial imagery of Linn County, Iowa, 2013 and were set to values appropriate for a given land use. Channel “n” values were set to 0.045 for all reaches. Table 4.1.1 summarizes “n” values for each conveyance corridor.

Table 4.1.1: Manning's "n" Values

Flooding Source	Overbank	Channel
All Drainage Ways	0.07	0.045



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N

Detailed Hydraulic Workmap
Watershed Management Plan
Robins, Iowa

0 400 800
Feet

Figure 4.1.1

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4.2. **Methodology**

Both the existing and future condition modeling were carried out with existing bridge and field survey data collected prior to February 2013.

The steady flow files used in the hydraulic models contained 12 flow change locations for one profile (100 year). Flow change locations were created at every location that flow rate information was available from the hydrologic model. This large number of flow changes allowed more accurate modeling of hydraulic conditions along each conveyance corridor. Normal depth, with a starting slope, was selected for use in establishing the boundary conditions for the existing conditions scenario and some of the conditions for the future conditions model. Other starting conditions were set based on known water surface elevations for the proposed regional retention basin during the 100 year recurrence interval storm.

Culvert sizes were investigated at the proposed King's Road crossing with two of the conveyance corridors. The culverts were sized to keep water surface elevation increases between the existing and the proposed conditions to be 3 feet or less during the 100 year storm. These sizes should be seen as estimates for initial cost analysis. The final design elements should be confirmed at the time of development.

4.3. **Results**

The difference in flood profile between existing and future models is a direct result of the hydrologic methodology. Elevation differences between the future and existing conditions can be found in Exhibit C, Detailed Hydraulic Results in the Appendix of this report. The maximum difference is highlighted in the difference column. Cross section stations in Exhibit C can be cross referenced to Figure 4.1.1 to determine elevations at particular locations.

5. **FLOODPLAIN MAPPING**

All floodplain mapping was delineated based on Iowa Statewide LiDAR data. Inundation mapping comparing existing condition and future condition floodplains can be seen on the previous Figure 4.1.1. Future conditions floodplain mapping overlain on the development concept can be seen on Exhibit A, Preliminary Floodplain and Regional Basin Elements in the Appendix of this report.

After hydraulic calibration, data from the HEC-RAS hydraulic model were exported for floodplain mapping using the HEC-GeoRAS extension within ArcGIS. Elevations were mapped at each cross section based on elevations calculated from the hydraulic model. The floodplains in between modeled cross sections were interpolated using a Digital Elevation Model (DEM) built using LiDAR data. The interpolation takes place as a part of the mapping processing within HEC-GeoRAS.

The existing condition and future condition floodplains were mapped using the appropriate model data described earlier in this report.

6. MANAGEMENT PLAN RECOMMENDATIONS

The following section prioritizes management strategies in the Zieser Properties watershed based on previous experience with other jurisdictions, and discussions between Snyder & Associates, City staff, and property owners.

6.1. Regional Retention Basin

Currently, individual basins are not performing adequately and the City commenced this study to determine the feasibility of a regional retention basin. Snyder & Associates has presented data and information that supports the feasibility of the desired regional retention in lieu individual basins. It will supply the watershed, the City, and its residents more benefits than if individual basins were constructed. A regional retention basin will provide:

1. Easier Maintenance **–** It will allow the City to enjoy increased maintenance efficiency due to the consolidation of many basins into one large basin.

2. More Effective Management **–** It would provide more efficient management for water quantity and sedimentation. Larger basins have proven to be more effective in practice for managing flood waters. The forebays allow convenient access with the proper equipment to remove sediment when needed.

3. Recreation **–** It would provide the community with considerably more recreational opportunities.

6.2. Forebay Construction

Sedimentation forebays are recommended to be constructed at the three entry points to the proposed regional retention basin. This will reduce the sediment loading to the main retention basin significantly which will prolong the time frame between construction and the need for dredging. Forebay construction will also ensure that the ecological quality in and around the retention basin remains as intended at the time of construction for a longer period of time. Forebays should be inspected frequently, especially during construction, for the need to clear sediment to ensure optimal performance. An example of a constructed forebay can be found in Figure 6.2.1 below.

Figure 6.2.1: Sedimentation Forebay Example

6.3. Conveyance Corridors

It is the recommendation of Snyder & Associates to reserve the 100-year floodplain as modeled at full build-out conditions to convey the 100-year storm flow to the proposed regional retention basin within publicly owned property. Establishing conveyance corridors owned by the City will provide reduced flooding concerns and reduced risk of future property damage. This will also ensure the City will be able to maintain the conveyance corridor as intended in perpetuity. This will reduce resident complaints and ownership issues. Conversely, traditional grading with large storm sewer infrastructure proves to be very expensive to build and maintain over time and is accompanied by overflow flooding concerns that increase the risk for future property damage.

Designs of conveyance corridors take on many shapes and aspects depending on the desires of the developer, end user, and/or the City. A more “natural” looking corridor can be found in Figure 6.3.1. This type of design can serve as an amenity to the neighborhood/community it travels within. Native grasses can be planted to give greater erosion protection and provide an opportunity for less maintenance in the long term, but can have higher effort and cost for establishment of vegetation. Turf grasses can be planted and established easier for a more manicured look by mowing the conveyance corridor on a regular schedule, but with a higher maintenance cost long term. However, turf grass may not provide as much erosion protection as native vegetation.

Figure 6.3.1: "Natural" Stream Design Example

A more "engineered" stream design can also be employed. This type of design employs hard armoring with rip-rap to reduce erosion concerns. An example can be seen in Figure 6.3.2. These designs also include less vegetation than natural designs and may not be seen as an amenity. Although hard armoring can provide less long term maintenance cost, it can be more expensive to construct.

Figure 6.3.2: “Engineered” Stream Design Example

A hybrid approach to the two methods can and has been used. An example of this can be seen in Figures 6.3.3 and 6.3.4. These two figures show Turf Reinforcement Mat (TRM) immediately after installation and after vegetation has had time to establish. TRM is used when a more natural manicured look is wanted, but there is a desire to increase the erosion protection. The TRM itself can be an interconnected textile mat or more robust thick plastic mat with perforations where vegetation can establish. Sub-drain installation is also common to mitigate extended wet periods in the channel during low flow conditions. These products can serve as a hybrid to both design approach and cost considerations.

Figure 6.3.3: Turf Reinforcement Mat After Installation

Figure 6.3.4: Turf Reinforcement Mat Post Vegetation Establishment

6.4. **Interim Sediment Forebays**

Due to sanitary sewer access the proposed development is anticipated to commence from south to north. Row crop agriculture is the dominate land use in the Zieser Property watershed and is anticipated to stay in production until the development concludes. This provides the increased opportunity during certain points in any given year for substantial sediment loading through the conveyance corridors and eventually to the regional retention basin downstream.

In agreement with the City, it is the recommendation of Snyder & Associates to require the installation of temporary sediment forebays and/or check dams upstream of developments as they are constructed to mitigate downstream water quality concerns. This practice will perform similar to the sedimentation forebays at the entry points of the regional detention basin by slowing the channel flow. This will allow for portions of the sediment to remain upstream. Additionally, any sediment that has accumulated behind any check dams should be required to be cleared by the developer to ensure it doesn't travel downstream after the check dam has been removed. An example of a check dam can be seen in Figure 6.4.1 below.

Figure 6.4.1: Rock Check Dam

6.5. Typical Corridor Section

In addition to the elements above, these designs should include Minimum Protection Elevations (MPEs) of at least one-foot above the 100 year water surface elevation near any water body or conveyance corridor. The MPEs will ensure a lowered future risk for property damage and other losses. An example conveyance corridor cross section can be seen in Figure 6.5.1 below.

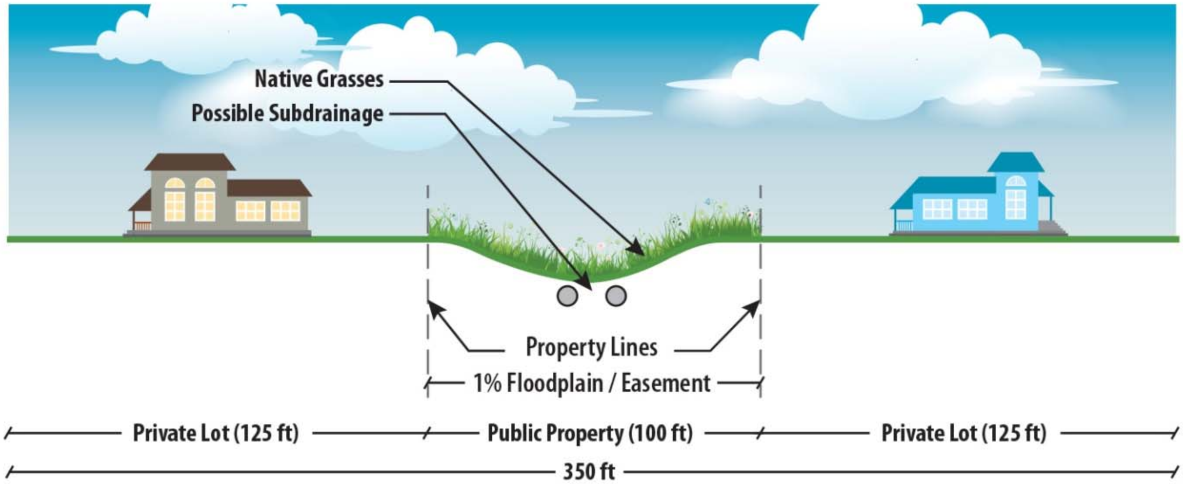


Figure 6.5.1: Example Corridor Cross Section

6.6. Recommendation Summary

6.6.1. Phase 1 – City Responsibility

- Recommendation #1
  - Construct a regional retention basin in lieu of requiring individual detention basins by developers.

- Recommendation #2
  - Build and maintain sedimentation forebays upstream of channel entry points into the regional retention basin.

6.6.2. Phase 2 – Developer Responsibility

- Recommendation #3
  - Reserve the future conditions 100 year floodplain to convey stormwater to the regional retention basin within public property.
  - Once the 100 year floodplain has been reserved, ensure that design standards from the ISMM for channel flow are used. This will ensure flow capacity of the channel will convey the 100 year peak flow while keeping velocities low enough at all recurrence interval storms to prevent erosive conditions in the channel.

  - Require MPEs of one-foot above the 100 year elevation along the basin and conveyance corridors.

- Recommendation #4
  - Require installation of sedimentation forebays upstream of development for water quality and quantity benefits.

7. FUNDING OPTIONS

There are several methods the City can use to recoup some or all of the design and construction costs from the end users of the regional retention basin. However, regardless of the revenue methods used, there is a need for the City to invest in the design and construction of the regional retention basin upfront for ease of compliance and enforcement when managing the stormwater within the watershed. The City can then set fees based on actual costs rather than a planning level cost opinion.

Below you will find discussion on three revenue options; a development impact fee, a building permit fee, and implementing a stormwater utility. These revenue options would spread out the financial responsibility to different entities rather than placing it on only one entity.

7.1. Development Impact Fee

This option would place some of the financial responsibility on subdivision developers. This impact fee would be collected at the time of final platting and be based on total area (acres) included within the proposed development. Different rates could be applied based on percentage of impervious area or specific land uses. The City would collect this fee before a final plat would be approved. For properties not required to plat before developing, these fees would be collected in conjunction with site plan approval.

7.2. Building Permit Stormwater Connection Fee

This option would place some of the financial responsibility on the actual builder of the dwelling and/or structure. This fee should be based on lot size (per acre rate). This will ensure the revenue from this funding option remains stable. If the fee were to be on a per lot basis the final revenue may be wholly different than the preliminary projection. The size and overall number of lots can vary widely from preliminary development plans and what is actually platted and constructed at the end of the process. This fee could also be modified based on impervious area, but would primarily be based on area within a given lot.

There are two mechanisms that could be used to collect this fee. First, the fee could be a standalone permit application that would need to be filed before a building could be constructed within the watershed specified in this report. Or, this fee could be added as an additional stipulation to the current Building Permit application form as a “YES/NO” option. The “YES/NO” option would be whether or not all or part of the proposed lot falls within the specified watershed. If yes, then the applicant would need to remit an additional stormwater connection fee based on the area that falls within the watershed before construction could commence.

7.3. Stormwater Utility

A stormwater utility can be used to fund two distinct portions of the proposed management plan. First, it can recoup the cost of design and construction of the regional retention basin. Second, it can also fund the ongoing long-term maintenance of the public conveyance and storm sewer system, the maintenance for the regional retention basin, and maintenance for the proposed sedimentation forebays.

Below is discussion on two alternate ways to approach implementing a stormwater utility. The first allocates monthly fees to all developed lots within the watershed. The second allocates a monthly fee to all developed lots within the City.

7.3.1. Watershed Stormwater Utility

This option would place some of the financial burden on the property owners within the specified watershed. A stormwater utility assessed within the watershed would be a monthly utility fee collected from each developed lot. Most often, different rates are to be remitted based on a particular land use and/or the amount of impervious area that is present within a given lot. For a residential lot in a city comparable with the City of Robins, the rate is typically based on a flat rate per month for each lot. For commercial/industrial/multi-family lots, it can be based on the amount of impervious area within the lot using an Equivalent Residential Unit (ERU) calculation. Alternatively, a higher standard rate can be used for commercial/industrial/multi-family lots. ERUs and using imperviousness to set particular rates is further discussed in Section 7.3.2 below.

7.3.2. Citywide Stormwater Utility

This option would place some of the financial burden on all of the property owners within the City. The proposed regional retention basin is not only going to serve its utilitarian purpose, but it will also be an amenity for the entire City and its residents and businesses. The proposed retention basin may include recreational elements with the design and construction. These elements will provide incentive for the basin to be enjoyed by multiple people that reside or do business outside of the specified watershed. In addition, it may also attract individuals that do not currently reside or do business within the City.

If this option is implemented, it would not be implemented in addition to a watershed only utility, but as a standalone utility. The City would then determine if a flat rate per lot would be used or if impervious area would be used as a basis for setting a rate for each individual lot, citywide. If imperviousness was chosen to set rates, an ERU would then need to be calculated.

An ERU is typically set by determining the average amount of imperviousness within a residential lot inside the City. Once an ERU has been calculated, a base rate per ERU is determined. All lot rates would then be set based on this base rate and the amount of impervious area within each lot. The final step would be to determine whether or not the City desires to use a land use factor to increase fees for high imperviousness land uses. Examples of how some rates would be calculated can be found in Tables 7.3.1 and 7.3.2 below. The example in Table 7.3.1 with varied rates assumes an ERU equals 4,000 sq. ft. of impervious area. This was determined by measuring a small cross section of lots within the City. The rate per ERU in Table 7.3.1 and the rates per lot in Table 7.3.2 were used for these examples after a review of rates for cities of similar size when compared to the City.

Table 7.3.1: Example Stormwater Utility Rates Using ERU Calculation

Land Use	Total Impervious Area (sq. ft.)	Parcel ERU	Rate per ERU	Land Use Factor	Total Monthly Stormwater Utility Fee
Residential A	3,500	0.88	$ 2.00	1.00	$ 1.75
Residential B	4,000	1.00	$ 2.00	1.00	$ 2.00
Residential C	5,500	1.38	$ 2.00	1.00	$ 2.75
Big Box Commerical	550,000	137.50	$ 2.00	1.50	$ 412.50
Small Commerical	70,000	17.50	$ 2.00	1.50	$ 52.50
Multi-Family	40,000	10.00	$ 2.00	1.50	$ 30.00

Table 7.3.2: Example Stormwater Utility Rates Using Flat Rates

Land Use	Total Impervious Area (sq. ft.)		Rate per Lot		Total Monthly Stormwater Utility Fee
Residential A	3,500		$ 2.00		$ 2.00
Residential B	4,000		$ 2.00		$ 2.00
Residential C	5,500		$ 2.00		$ 2.00
Big Box Commerical	550,000		$ 35.00		$ 35.00
Small Commerical	70,000		$ 35.00		$ 35.00
Multi-Family	40,000		$ 35.00		$ 35.00

7.4. **Funding Analysis**

The City can choose to pay for some or all of the design and construction with City funds and sources. However, the funding example shown below is based on 100% of the cost being paid for, or recouped by, the various fees that could be collected. Although the City can choose any combination of funding, the funding example shown below includes an equal 1/3 share collected from each of the three funding options discussed; a development impact fee, a building permit fee, and implementing a stormwater utility. The example is followed by discussion on how this would affect the implementation of a stormwater utility.

7.4.1. **Funding Options Example**

The regional retention basin is proposed to manage approximately 460 acres including small areas to the east of Quass Road and to the west of North Center Point Road. The order of magnitude cost opinion prepared and presented as Exhibit C in the Appendix of this report shows an estimated design and construction cost of $2.1 million. That would equate to a total cost of approximately $4,582 per watershed acre. Table 7.4.1 below shows how the costs can be recouped by assigning 1/3 of the total cost to each of the three funding options discussed in Sections 7.1 through 7.3. Table 7.4.2 provides what a Development Impact Fee may be for selected example developments. Table 7.4.3 provides what a Building Permit Fee may be for selected example developments.

Table 7.4.1: Funding Summary

Funding Source	*Total Fee Needed	Total Watershed Area (acres)	**Per Acre Fee		Total Fee Collected
Development Impact Fee	$ 702,666.67	460	$ 1,527.54		$ 702,666.67
Building Permit Connection Fee	$ 702,666.67	460	$ 1,527.54		$ 702,666.67
Stormwater Utility	$ 702,666.67	460	N/A		$ 702,666.67
				TOTAL	**$ 2,108,000.00**
*$2,108,000 / 3 = $702,666.67					
**$702,666.67 / 460 = $1,527.54					

Table 7.4.2: Watershed Development Impact Fee Examples

Funding Source	Per Acre Fee		Development Area (acres)		Development Impact Fee
40 Acre Residential Development	$ 1,527.54		40.00		$ 61,101.60
20 Acre Commerical Development	$ 1,527.54		20.00		$ 30,550.80
Total Build Out	$ 1,527.54		460		$ 702,666.67

Table 7.4.3: Watershed Building Permit Fee Examples

Funding Source	Per Acre Fee		Lot Area (acres)		Building Permit Fee
0.25 Acre Residential Lot	$ 1,527.54		0.25		$ 381.89
0.33 Acre Residential Lot	$ 1,527.54		0.33		$ 504.09
20 Acre Commerical Development	$ 1,527.54		20.00		$ 30,550.80
Total Build Out	$ 1,527.54		460		$ 702,666.67

7.4.2. **Stormwater Utility Fee Analysis**

Further analysis was completed for the stormwater utility option using the information found in Table 7.4.1 above and additional information presented in this section.

Based on a preliminary plan that was concepted by Snyder & Associates, and considering management options in this report, a total number of developed lots were estimated for the watershed. This estimate was then added to the total number of developed lots that were estimated to be currently within the City. As shown in Table 7.3.2, a flat-rate monthly stormwater utility rate for a residential lot was assumed to be $2/month and the average rate for a commercial/industrial/multi-family lot was assumed to be $35/month. These rates were used after a brief review of other area stormwater utility fees. These estimates were then used to calculate estimated yearly stormwater utility collection for the two options. Finally, a payback period was calculated based on the amount of total fee needed to pay the equal portion from a previous section.

Unfortunately, there is no way to determine when the specified watershed would be fully developed. The same challenge exists when trying to determine additional lots that may be developed within the City, but not within the studied watershed. Consequently, for comparison purposes, the analysis was completed assuming all lots were already fully developed within the watershed. It was also completed utilizing lots developed within the City as of 2014 assuming no future growth, the flat-rate stormwater utility fees would never increase, and the goal being to cover 1/3 of the total project costs as shown in Table 7.4.1. The results are presented in Table 7.4.4 below.

Table 7.4.4: Stormwater Utility Impact Summary

Funding Source	Total Residential Parcels	Residential Monthly Rate***	Total Non-Residential Parcels	Non-Residential Monthly Rate***	Total Yearly Fee Collected	Total Fee Needed	Payback (years)
Watershed Stormwater Utility	500*	$ 2.00	6*	$ 35.00	$ 14,520.00	$702,666.67	48.4
Citywide Stormwater Utility	1730**	$ 2.00	25**	$ 35.00	$ 52,020.00	$702,666.67	13.5

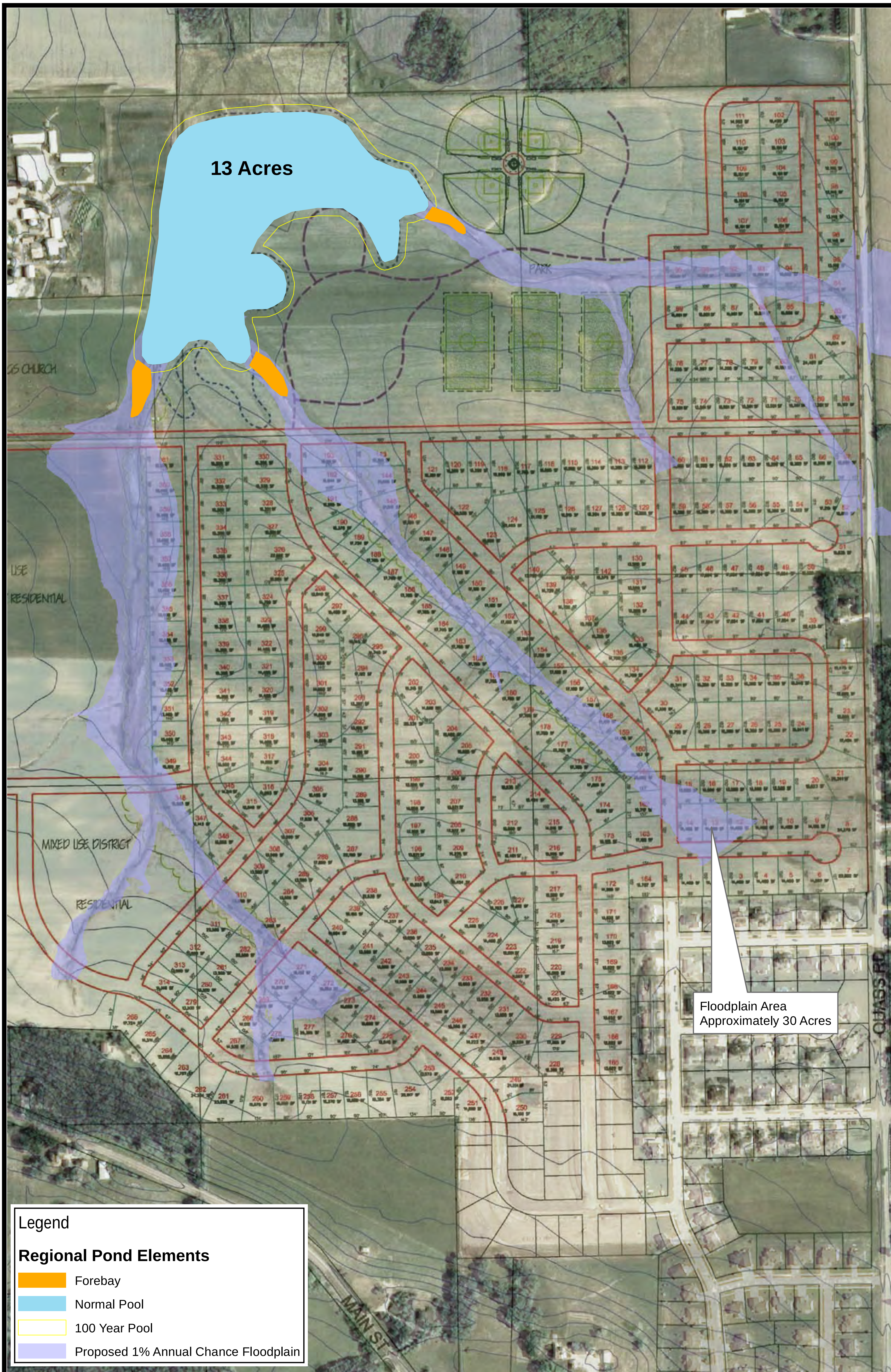
*Lots approximated by land-use estimates
**Includes existing lots and estimated watershed lots
***As shown in Table 7.3.2

8. **PUBLIC MEETING**

A public meeting was held as a part of the regularly scheduled City council meeting on November 3, 2014. Elements within this report were discussed at length accompanied by a PowerPoint presentation. Comments were received from, residents, City staff, and City council that have been incorporated into this report.

APPENDIX: PROJECT EXHIBITS

Exhibit A: Preliminary Floodplain and Regional Basin Elements
Exhibit B: Engineers Preliminary Opinion of Probable Construction Costs
Exhibit C: Detailed Hydraulic Results
Public Meeting PowerPoint Presentation



Snyder & Associates
Engineers and Planners

Preliminary Floodplain and Regional Basin Elements
Watershed Management Plan
Robins, Iowa

0 175 350
Feet

Exhibit A

Document Path: J:\2014_Projects\114.0405.08\GIS\Deliverables\Pond_FP_Layout.mxd

ENGINEERS PRELIMINARY OPINION
OF PROBABLE CONSTRUCTION COSTS
REGIONAL DETENTION BASIN
ROBINS, IOWA
January 13, 2015

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
	GENERAL				
1.1	Mobilization	1	LS	$ 75,000.00	$ 75,000.00
				SUBTOTAL	$ 75,000.00
	EARTHWORK				
2.1	Excavation & Grading	338,000	CY	$ 4.00	$ 1,352,000.00
				SUBTOTAL	$ 1,352,000.00
	STORM SEWER				
3.1	Culvert, RCP, 15"	150	LF	$ 50.00	$ 7,500.00
3.2	Precast 6X6 RCBC	120	LF	$ 750.00	$ 90,000.00
				SUBTOTAL	$ 97,500.00
	OUTLET STRCUTURE				
4.1	Multi-Stage Outlet Structure	1	LF	$ 10,000.00	$ 10,000.00
				SUBTOTAL	$ 10,000.00
	SITE WORK AND LANDSCAPING				
6.1	Seeding	15	AC	$ 1,000.00	$ 15,000.00
				SUBTOTAL	$ 15,000.00
				SUBTOTAL =	$ 1,549,500.00
				CONTINGENCY (20%) =	$ 310,000.00
				ENGINEERING AND CONSTRUCTION SERVICES (16%) =	$ 248,000.00
				TOTAL =	$ 2,108,000.00

Exhibit B

Exhibit C
Detailed Hydraulic Results
Watershed Management Plan - Zieser Properties
HEC-RAS Results: Future vs. Existing

River	Reach	Station	Existing Conditions Model 100 Year (ft)	Future Conditions Model 100 Year (ft)	Difference (Existing - Future)	Remark
East Branch	Main	479	826.86	826.53	-0.33	
East Branch	Main	682	827.96	828.20	0.24	
East Branch	Main	899	829.31	829.25	-0.06	
East Branch	Main	1172	832.56	832.88	0.32	
East Branch	Main	1373	834.52	834.62	0.10	
East Branch	Main	1636	836.97	837.12	0.15	
East Branch	Main	1735	838.12	838.22	0.10	
East Branch	Main2	1968	840.01	840.18	0.17	
East Branch	Main2	2096	841.27	841.41	0.14	
East Branch	Main2	2194	842.38	842.50	0.12	
East Branch	Main2	2288	843.09	843.27	0.18	
East Branch	Main3	2498	844.78	844.96	0.18	
East Branch	Main3	2655	846.37	846.49	0.12	
East Branch	Main3	2817	853.80	853.86	0.06	
East Branch	Main3	2937	854.02	854.12	0.10	
East Branch	Main3	3057	854.03	854.13	0.10	
East Branch	Main3	3195	854.05	854.15	0.10	
East Branch	Main3	3389	854.94	855.07	0.13	
East Branch	Main3	3529	856.77	856.87	0.10	
East Branch	Main3	3677	859.03	859.13	0.10	
East Branch	Main3	3898	862.81	862.91	0.10	
East Branch	Main3	4032	864.71	864.82	0.11	
East Branch	Main3	4172	866.44	866.56	0.12	
EB Trib A	Main	113	839.16	839.28	0.12	
EB Trib A	Main	234	840.98	841.04	0.06	
EB Trib A	Main	469	847.70	847.74	0.04	
EB Trib A	Main	628	853.13	853.17	0.04	
EB Trib A	Main	837	858.20	858.24	0.04	
EB Trib B	Main	161	845.14	845.22	0.08	
EB Trib B	Main	274	847.72	847.80	0.08	
EB Trib B	Main	371	850.03	850.10	0.07	
EB Trib B	Main	515	853.54	853.61	0.07	
EB Trib B	Main	641	856.59	856.67	0.08	
EB Trib B	Main	800	861.09	861.14	0.05	
EB Trib B	Main	974	865.62	865.65	0.03	
EB Trib B	Main	1097	868.44	868.56	0.12	
WB Trib A	Main	127	830.87	831.12	0.25	
WB Trib A	Main	304	833.02	833.17	0.15	
WB Trib A	Main	441	834.98	835.11	0.13	
WB Trib A	Main	550	835.88	836.03	0.15	
WB Trib A	Main	682	837.19	837.35	0.16	
WB Trib A	Main	765				Proposed Twin - 6' X 4' RCBC
WB Trib A	Main	868	838.98	842.13	3.15	
WB Trib A	Main	1051	841.09	842.14	1.05	
WB Trib A	Main	1259	843.83	843.99	0.16	
WB Trib A	Main	1455	847.37	847.56	0.19	
WB Trib A	Main	1770	851.25	851.40	0.15	
WB Trib A	Main	1964	854.17	854.28	0.11	
WB Trib A	Main	2221	858.77	858.88	0.11	
WB Trib A	Main	2409	861.93	862.09	0.16	
WB Trib A	Main	2634	865.86	866.07	0.21	
WB Trib A	Main	2775	867.80	867.93	0.13	
WB Trib A	Main	2922	868.87	869.02	0.15	
WB Trib A	Main	3097	870.55	870.64	0.09	
WB Trib B	Main	173	847.61	847.90	0.29	
WB Trib B	Main	458	853.58	853.78	0.20	
WB Trib B	Main	699	859.19	859.44	0.25	
WB Trib B	Main	914	865.55	865.72	0.17	
West Branch	Main	337	826.19	825.90	-0.29	
West Branch	Main	458	826.97	827.31	0.34	
West Branch	Main	622	827.82	828.05	0.23	
West Branch	Main	769	828.75	828.98	0.23	
West Branch	Main	960	830.05	830.33	0.28	
West Branch	Main2	1173	831.27	831.53	0.26	
West Branch	Main2	1262	831.89	832.17	0.28	
West Branch	Main2	1368	832.96	833.22	0.26	
West Branch	Main2	1518	834.49	834.79	0.30	
West Branch	Main2	1635				Proposed Twin - 12' X 6' RCBC
West Branch	Main2	1747	836.32	839.51	**3.19**	
West Branch	Main2	1896	837.47	839.53	2.06	
West Branch	Main2	2032	838.49	839.62	1.13	
West Branch	Main2	2143	839.33	839.82	0.49	
West Branch	Main2	2308	840.89	841.07	0.18	
West Branch	Main2	2414	841.95	842.25	0.30	
West Branch	Main2	2577	843.69	843.94	0.25	
West Branch	Main2	2836	845.65	845.93	0.28	
West Branch	Main3	3138	847.67	847.91	0.24	
West Branch	Main3	3339	849.37	849.44	0.07	
West Branch	Main3	3553	852.23	852.43	0.20	
West Branch	Main3	3743	854.55	854.64	0.09	
West Branch	Main3	4030	862.13	862.18	0.05	
West Branch	Main3	4281	870.09	870.27	0.18	
West Branch DS	Main	60	814.69	813.00	-1.69	
West Branch DS	Main	247	815.39	813.74	-1.65	
West Branch DS	Main	445	816.27	814.89	-1.38	
West Branch DS	Main	521				County Home Road
West Branch DS	Main	594	822.14	818.78	-3.36	
West Branch DS	Main	727	822.15	818.83	-3.32	
West Branch DS	Main	904	822.17	818.89	-3.28	
West Branch DS	Main	1031	822.19	818.98	-3.21	
West Branch DS	Main	1207	822.24	819.36	-2.88	
West Branch DS	Main	1405	822.37	820.22	-2.15	
West Branch DS	Main	1528	822.54	820.82	-1.72	
West Branch DS	Main	1660	822.90	822.03	-0.87	

Maximum

Elevations presented in this table are referenced to NAVD88