ILLINOIS TOLLWAY | Plainfield Road_Looking West, Aerial View

MAR 2019

ILLINOIS TOLLWAY | Plainfield Road_Overall Aerial View

MAR 2019

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DRAWN BY	SCALE 1"=100'	Gannett Fleming	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY 2700 OGDEN AVENUE DOWNERS GROVE, ILLINOIS 60515	REVISIONS NO. / DATE / DESCRIPTION	CONTRACT NO. I-18-4428
CHECKED BY	DATE 3/25/2019				GROUND IMPROVEMENT PLAN

SHEET NO.
DRAWING NO.
OF $TOT

TRAFFIC NOISE STUDY AND ABATEMENT POLICY
ILLINOIS STATE TOLL HIGHWAY AUTHORITY

1.0 PURPOSE AND OVERVIEW

The Illinois Tollway's (Tollway's) Traffic Noise Study and Abatement Policy update provides an opportunity to evaluate traffic noise throughout the implementation of projects proposed as part of the Tollway's capital improvement programs.

The Tollway's current policy addresses guidelines and procedures for initiating traffic noise studies and considering traffic noise abatement. The policy first establishes the eligibility requirements for a Traffic Noise Study. The policy then establishes the requirements for considering the construction of traffic noise abatement structures and when traffic noise abatement is feasible and reasonable.

The traffic noise analysis guidance provided in this policy is based largely on the regulatory material found in Title 23 Code of Federal Regulations Part 772 (23 CFR Part 772) entitled "Procedures for Abatement of Highway Traffic Noise and Construction Noise."

If initial traffic noise impact screening assessments indicate the possibility of future traffic noise impacts, then a Traffic Noise Study will be performed. A detailed technical memorandum will be prepared to document the assumptions, data, procedures, results and traffic noise abatement considerations and recommendations from the Traffic Noise Study.

2.0 DEFINITIONS

Adjacent Land Use – The land use that is within 500 feet of the Tollway highway proposed edge of pavement.

Approach - For the purpose of this policy, approaching means within 1 decibel (dB(A)) of the appropriate Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) as adopted by the Tollway.

dB(A) – A weighted decibel. The decibel is a unit of measurement on a logarithmic scale that describes the relative magnitude of sound levels with respect to a standard reference value. Decibels are defined as ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure to the reference mean-square sound pressure of 20 micro-Pascals, the threshold of human hearing. The A-weighting network is an electronic filter defined by the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO) that closely simulates the relative response of the human ear.

Date of Public Knowledge – This is the date that the Tollway's capital improvement program from which the project is funded received Board approval for project construction. This date establishes the "Date of Public Knowledge" and determines when the Tollway is no longer

responsible for providing noise abatement for new developments adjacent to projects included in the capital improvement program.

Exterior Traffic-Generated Noise – This is traffic-generated noise that is measured on the exterior of the receptor as opposed to the interior. The noise model (TNM®) and Policy generally refer to exterior noise only.

L_{eq} – The Equivalent Sound Level, denoted by L_{eq}, is the steady-state sound having the same A-weighted sound energy as that contained in the time-varying sound over a specific period of time. The L_{eq} correlates reasonably well the effects of noise on people.

$L_{eq(h)}$ – The Equivalent Sound Level over a one-hour period.

Noise Abatement Criteria – Noise impact thresholds for considering abatement. (Abatement must be considered when predicted traffic noise levels for the design year approach [i.e., are within 1 decibel of], equal to, or exceed the noise abatement criteria, or when the predicted traffic noise levels are substantially higher [i.e., are more than 14 decibels greater] than the existing noise level.) The Noise Abatement Criteria are not attenuation design criteria or targets. The goal of noise abatement measures is to achieve a substantial reduction in future noise levels. The reductions may or may not result in future noise levels at or below the Noise Abatement Criteria.

Noise Abatement – A structure, land configuration, object or other measure that attenuates or is intended to attenuate traffic noise. Generally considered to be a barrier or wall, abatement could also be in the form of earth berms, landscaping, or any combination of the aforementioned.

Noise Sensitive Receptor – Receptor locations with identified outdoor human activity including: residences, picnic areas, recreation areas, playgrounds, active sports areas, parks, motels, hotels, schools, churches, libraries, hospitals and other land uses detailed in Table 1.

Receptor – A point used in a traffic noise study for which the traffic-generated noise level is determined. A receptor is generally placed in an area of active outdoor human use. Normally, the areas of active outdoor human use include areas such as patios, swimming pools, porches, balconies, etc. Sites considered include homes, condominiums, apartments, permanent mobile home communities and parks. The associated type of outdoor human activity and the sensitivity to traffic noise will define which parks are considered receptors.

Substantial Increase – Traffic noise levels that are predicted to be more than 14 dB(A) over existing traffic noise levels.

Traffic Noise – Noise generated from vehicles traveling on the roadway. Noise is usually generated at the tire/pavement interface, from vehicle/truck engines, and from heavy truck exhaust systems.

Traffic Noise Study – A study of traffic-generated noise to determine: the existing traffic noise level conditions at receptors representative of normal outside human use; potential future traffic noise levels; an assessment of traffic noise impacts; and consideration of potential, feasible and effective economically reasonable traffic noise abatement. The study is conducted through the use of computer modeling. These studies would utilize the FHWA Traffic Noise Model (TNM® 2.5) or the most recent version. The methodology is consistent with 23 CFR 772 which explains processes to be followed in noise analyses and studies.

Type I Projects – A proposed project for the construction of a roadway in a new location or the physical alteration of an existing roadway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes. The following is obtained from the FHWA *"Procedures for Abatement of Highway Traffic Noise and Construction Noise,"* (23 CFR Part 772).

1. The construction of a highway on new location; or,

2. The physical alteration of an existing highway where there is either:

    a. *Substantial Horizontal Alteration*. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,

    b. *Substantial Vertical Alteration*. A project that removes shielding, therefore exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,

3. The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, High-Occupancy Toll (HOT) lane, bus lane, or truck climbing lane; or,

4. The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,

5. The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,

6. Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,

7. The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

If a project is determined to be a Type I project under this definition, then the entire project area, as defined in the environmental documentation, is a Type I project.

Type II Projects – A Community Noise Abatement Project proposed for traffic noise abatement on an existing roadway which is not associated with any Type I improvement.

Type III Projects – A project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

Undeveloped Properties – Property that is currently vacant or is likely to be redeveloped into an approved-for-construction land use by the local governmental body having jurisdiction. To be considered eligible for a traffic noise analysis and noise abatement, the undeveloped property must have secured permits for construction by a governing body prior to the Date of Public Knowledge.

3.0 PROCESS FOR DETERMINING WHEN A TRAFFIC NOISE STUDY AND ABATEMENT WILL BE CONSIDERED

3.1. Projects Eligible for a Traffic Noise Study

A Traffic Noise Study is warranted when **all** of the following conditions are present:

3.1.1. When the Tollway undertakes engineering studies or projects that meet the definition of a Type I project, ***or*** project locations that meet two criteria: 1)the initial roadway construction did not consider the effect of traffic noise **and** 2) the traffic volumes have, or are projected to at least double from the initial construction.

3.1.2. When the adjacent land use consists of identified outdoor human activity that are identified within Activity Category A, B, C, D or E, detailed in Table 1. Also considered are locations where undeveloped adjacent properties have secured permits for construction of the above outdoor human activity land uses by the jurisdiction or municipality having permit and zoning authority prior to the Date of Public Knowledge.

3.1.3. When the location of noise sensitive receptors is within 500 feet from the proposed or existing edge of shoulder, as highway traffic noise impacts are not typical for receptors more than 500 feet from heavily traveled roadways.

3.1.4. The considerations for Type II projects are discussed in Section 6.0.

3.2. Projects Not Eligible for Traffic Impact Analysis

A Traffic Noise Study is not warranted for Type III projects.

4.0 TRAFFIC NOISE IMPACT ANALYSIS

- **Cursory Review:** The initial traffic noise impact assessment for all projects will be a cursory review. This assessment would determine if noise sensitive receptors are within the project limits' adjacent land use, if traffic noise impacts are already present, and if future traffic noise levels are likely to increase. This review would include assessment of existing and proposed land use plans, review of aerial photography, and a review of prior studies.

- **Identifying Noise Sensitive Receptors:** Receptors shall be identified based on the activity categories and described land use listed in Table 1.

Table 1
Noise Abatement Criteria
[Hourly A-Weighted Sound Level-decibels (dB(A))]

Activity Category	L_{eq}(h)	Evaluation Location	Activity Description
A	**57**	**Exterior**	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	**67**	**Exterior**	Residential.
C	**67**	**Exterior**	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	**52**	**Interior**	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	**72**	**Exterior**	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	**---**	**---**	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	**---**	**---**	Undeveloped lands that are not permitted.

* Title 23 Code of Federal Regulations Part 772 (*23 CFR Part 772*)

** Use of interior noise levels shall be limited (on a case-by-case basis) to land uses within Activity Category D where exterior noise levels are not applicable, i.e., where there are no exterior activities to be affected by traffic noise, or where exterior activities are far from or physically shielded from the roadway in a manner that prevents an impact on exterior activities.

Note: *The Noise Abatement Criteria (NAC) are noise* ***impact*** *thresholds for considering abatement. (Abatement must be considered when predicted traffic noise levels for the design year approach [i.e., are within 1 decibel of] or exceed the noise abatement criteria, or when the predicted traffic noise levels are substantially higher [i.e., are more than 14 decibels greater] than the existing noise level.) The Noise Abatement Criteria are* ***not*** *attenuation design criteria or targets. The goal of noise abatement measures is to achieve a substantial reduction in future noise levels. The reductions may or may not result in future noise levels at or below the Noise Abatement Criteria.*

- **Field Noise Monitoring:** A representative number of short-term 10-minute to 15-minute L_{eq} field monitoring traffic noise measurements shall be taken. The existing scenario traffic noise model shall be validated through a comparison of the field measured noise levels and the TNM predicted noise levels.

- **Determination of Traffic Noise Levels:** All viable alternatives for all study years (existing and design) will be examined using approved procedures incorporating the best available information and current professional judgment. Existing noise levels at noise sensitive receptor locations shall be determined by using modeling using the most current version of the FHWA-approved TNM (TNM) and/or field measurements. TNM modeling may not be representative of existing conditions if the roadway project is the construction

of a new roadway on new alignment and there is no existing traffic noise contribution. Traffic noise monitoring results should be used to represent existing noise levels in these scenarios. Future condition noise levels shall be predicted using TNM for both the build and no-build conditions. Existing noise levels predicted by TNM shall be validated through comparison of the field noise monitored noise levels and the predicted noise levels. Traffic noise levels should be predicted based on the traffic characteristics that yield the worst traffic noise, typically peak-hour traffic levels or level of service C. The $L_{eq(h)}$ noise metric shall be used to quantify the measurements of both existing and predicted noise levels.

- **Determination of Traffic Noise Impacts:** When determining traffic noise impacts, primary consideration shall be given to exterior areas of frequent human use. Noise impacts occur when the predicted build scenario traffic noise levels approach, meet, or exceed the Noise Abatement Criteria (NAC) provided in Table 1. The other potential noise impact occurs when predicted build year traffic noise levels substantially increase (increase by more than 14 dB(A)) over the predicted existing traffic noise levels. Some Tollway locations will involve existing traffic noise levels that already approach or exceed the NAC. Under these conditions, even if the proposed project will not cause the traffic noise levels to increase above existing levels, traffic noise abatement will be considered. If, after preparing a computerized traffic noise modeling and the corresponding Traffic Noise Study, it is determined that traffic noise levels will approach or exceed the NAC or the project will cause a substantial traffic noise increase, then traffic noise abatement measures will be considered. The feasibility and reasonableness factors for noise abatement consideration are outlined in Section 5.

5.0 Traffic Noise Abatement Considerations

Once a traffic noise impact has been determined at a noise sensitive receptor, the following feasibility and reasonableness factors will be evaluated and considered in order to determine if traffic noise abatement is warranted.

5.1. Feasibility

- **Noise Reduction Design Goal**: The traffic noise reduction design goal will be 8 dB(A) or more at a minimum of one receptor location. However, the minimum acceptable noise reduction on the first row of receptors will be 5 dB(A) at a minimum of one receptor location. The more noise reduction achieved the better the traffic noise abatement, as long as the cost, visual impact, etc., do not become excessive. If a minimum 5 dB(A) noise reduction cannot be achieved, a noise barrier will not be considered to be feasible.
- **Constructability**: The noise barrier conceived could actually be constructed using routine standard construction methods and techniques. Factors affecting this will include terrain, utilities, safety, bridges, overpasses, and similar difficulties.
- **Maintainability**: The noise barrier cannot be constructed in a location that inhibits or complicates proper maintenance.
- **Safety**: A critical factor in determining whether abatement is viable is the impact it may have on safety.

- **Utilities**: The impact of noise barriers on utilities and the reverse must be addressed early in the process. Overhead power lines, underground water, sewer, gas, oil, fiber optics, etc. can have a significant impact on costs and design options.
- **Drainage**: One of the most important elements in the physical location and design of noise abatement is drainage. Directing water along, under, or away from a noise abatement structure can be expensive and cause construction and long-term maintenance problems.

5.2. Reasonableness

5.2.1. Cost Effectiveness Evaluation: Cost factors will include the cost of construction (material and labor), the cost of the right-of-way (ROW) (including easements, etc.), and any other associated costs. The estimated cost of $30 per square foot of noise barrier will be used for the cost of construction for noise barriers. This unit cost value will be re-evaluated at least every 5 years by the Tollway. Traffic noise abatement must be cost-effective. The Traffic Noise Study will include a cost per benefited residence analysis that will be used to assist in the final determination of traffic noise abatement recommendations. If traffic noise abatement cannot be achieved in a cost effective and economically reasonable manner, traffic noise abatement will not be included in the project. ROW impacts can include the cost to obtain access rights, easements and land. It also includes the consideration of purchase, donation, etc. If access rights and easements are required, these will typically be by donation. This is in consideration of the construction of the traffic noise abatement wall being for the benefit of the property owners.

The consideration of the reasonableness factors, including the relationship of future noise levels to abatement criterion, noise level change from the existing condition to the future build condition, and antiquity are factors within the cost-effective evaluation. The cost-effective evaluation will be based on a base value of $30,000 per benefited receptor. In addition, each of the following factors can be considered in the cost-effective evaluation to increase the base value up to a maximum value of $45,000.

- **Relationship of Future Levels to Abatement Criterion**: Is the predicted future noise level from the project approaching or above 67 dB(A) $L_{eq(h)}$? Will it be within 1 dB(A) of the NAC or is it more on the order of 5 dB(A) or more above the NAC?

- **Noise Level Change from the Existing Condition to the Future Build Condition**: Is the future noise level substantially higher than the existing condition? Would the noise level be considered an impact by approaching the NAC or by increasing by greater than 14 dB(A)?

- **Antiquity**: Who was there first, the noise sensitive receptor or the roadway? How long has the noise sensitive receptor been there relative to elevated traffic noise levels? Is the Tollway dealing with original owners or recent purchasers? This implies that someone who builds or buys at a noise sensitive receptor location along

an existing roadway (or within the corridor where a roadway is planned for construction) probably doesn't consider traffic noise a significant factor in their selection of the location

Tables 2, 3, and 4 provide factors that allow for increases to be added to the base value for each of the three factors identified.

Table 2
Relationship of Future Noise Levels to Noise Abatement Criterion

Predicted Build Noise Level Above Noise Abatement Criterion	Dollars Added to Base Value Cost per Benefited Receptor
Less than 3 dB(A)	$0
4 to 5 dB(A)	$1,000
6 to 8 dB(A)	$2,000
Greater than 8 dB(A)	$5,000

Table 3
Noise Level Change from the Existing Noise Condition to the Future Build Noise Condition

Increase in Noise Levels from the Existing Condition to the Future Build Condition	Dollars Added to Base Value Cost per Benefited Receptor
Less than 3 dB(A)	$0
4 to 5 dB(A)	$1,000
6 to 8 dB(A)	$2,000
Greater than 8 dB(A)	$5,000

Table 4
Antiquity Consideration

Project is on new alignment OR the receptor existed prior to the original construction of the highway	Dollars Added to Base Value Cost per Benefited Receptor
No for both	$0
Yes for either	$5,000

***Example:** There is a residential receptor that existed prior to the original construction of the roadway. The receptor's Existing Condition noise level is 63 dB(A) and the Future Build Condition noise level is 71 dB(A). This receptor's adjustment factors are $1,000 from Table 2, $2,000 from Table 3, and $5,000 from Table 4, for a total adjustment of $8,000. This value of $8,000 is added to the base value of $30,000 for a total allowable cost of $38,000 for this receptor.

One adjustment value from each of the three factor tables can be added to the base value to increase the cost per benefited receptor value up to an increase of $15,000, or a total cost of $45,000. This adjustment procedure allows for extra consideration of these factors in order to determine a reasonable cost basis. If the actual build cost is less than the adjusted allowable cost per benefited receptor, and the noise abatement measure is determined to feasible, it would be considered for construction as part of the proposed project.

Noise abatement measures that are considered feasible and reasonable to implement into the project will be reviewed with the public through the public involvement process. The community desire for the noise wall will be considered as part of the final noise abatement measure implementation.

5.2.2. Community Desires: Important in determining if traffic noise abatement should be built at any location is whether the affected community really desires abatement. This may require that a survey or community outreach effort be conducted to assess the community desires. If the community is not in favor of the noise abatement, the Tollway may choose not to build traffic noise abatement features. If access rights are required, the Tollway will attempt to determine if the affected property owners are willing to trade those rights for the abatement without any exchange of money.

5.2.3. Views of Local Officials: Consideration should be given to the views of the local representative authorities who may be asked to represent the views of the citizens.

5.2.4. Other Considerations:

- **Seasonal Usage**: Some receptors are not occupied or utilized year round. The evaluation will consider usage rates throughout the year.
- **Land Use Stability**: Sometimes the land use for the area expected to change in the future. An example of this is the fact that commercial land uses or other land uses where visual exposure is integral to their existence and vitality may not warrant traffic noise abatement.
- **Local Controls**: In some instances, the local governing or jurisdictional body has not done anything to control noise sensitive land uses from building adjacent to the Tollway corridor or ROW. This implies that if no controls are used, traffic noise abatement is not a very high priority within the community.
- **Aesthetics**: This refers to the physical appearance of the wall from both the roadway side and the community side. It also incorporates the landscaping concept, the opinions of the property owners and the local community desires.
- **Other Environmental Issues**: This refers to impacts of traffic noise abatement installation that should be considered on a site-by-site basis. Examples include but not limited to unwanted reflection of sound, pedestrian, bicycle and trail disruption, wetland destruction, groundwater or surface water impacts, animal migration/flight paths, air quality, shading of vegetation, snow accumulation, etc.

6.0 Community Cost-Sharing Noise Abatement Projects

6.1. Type II Projects:

The following establishes a cost-shared policy to consider requests for retrofitting noise abatement for projects that are not associated with any Type I improvement. Retrofit projects are subject to available funding and will be evaluated for their merits on a case-by-case basis.

In order for a retrofit project to be considered for Type II funding, the project must have a state or local government sponsor, i.e., a unit of government with the authority to levy taxes. This includes general-purpose units of local governments (e.g., cities, counties and townships) as well as specialized governing districts (e.g., sanitary districts, school districts, forest preserve districts, park districts, airport authorities and publicly owned universities or colleges).

For a project to be considered for Type II funding, the local agency sponsor must prepare documentation in accordance with the traffic noise impact analysis and Traffic Noise Study requirements outlined in Section 4.0. The local agency sponsor must pass local zoning ordinances regarding land use, provide all necessary ROW, demonstrate the ability and commitment to provide a minimum of 50% of the funding for the project, and agree to maintain the traffic noise abatement structure and ROW on the community side of the structure.

The Tollway will give priority consideration to those communities where the roadway was constructed through an existing neighborhood and where 75 percent or more of the existing noise sensitive receptors within 500 feet of the edge of pavement preceded the roadway. Developments platted or approved after the date of public knowledge will not be eligible for Type II funding consideration.

6.2. Receptor Locations Not Achieving Cost Effectiveness Criterion

The following establishes a cost-sharing policy for receptor locations that did not meet the cost effectiveness criterion within a Tollway Type I project Traffic Noise analysis. Cost-share opportunities are subject to available funding and will be evaluated for their merits on a case-by-case basis. For noise abatement to be considered for cost-sharing, the receptor location needs to have been determined to be impacted by traffic noise, as determined by a completed Traffic Noise Analysis.

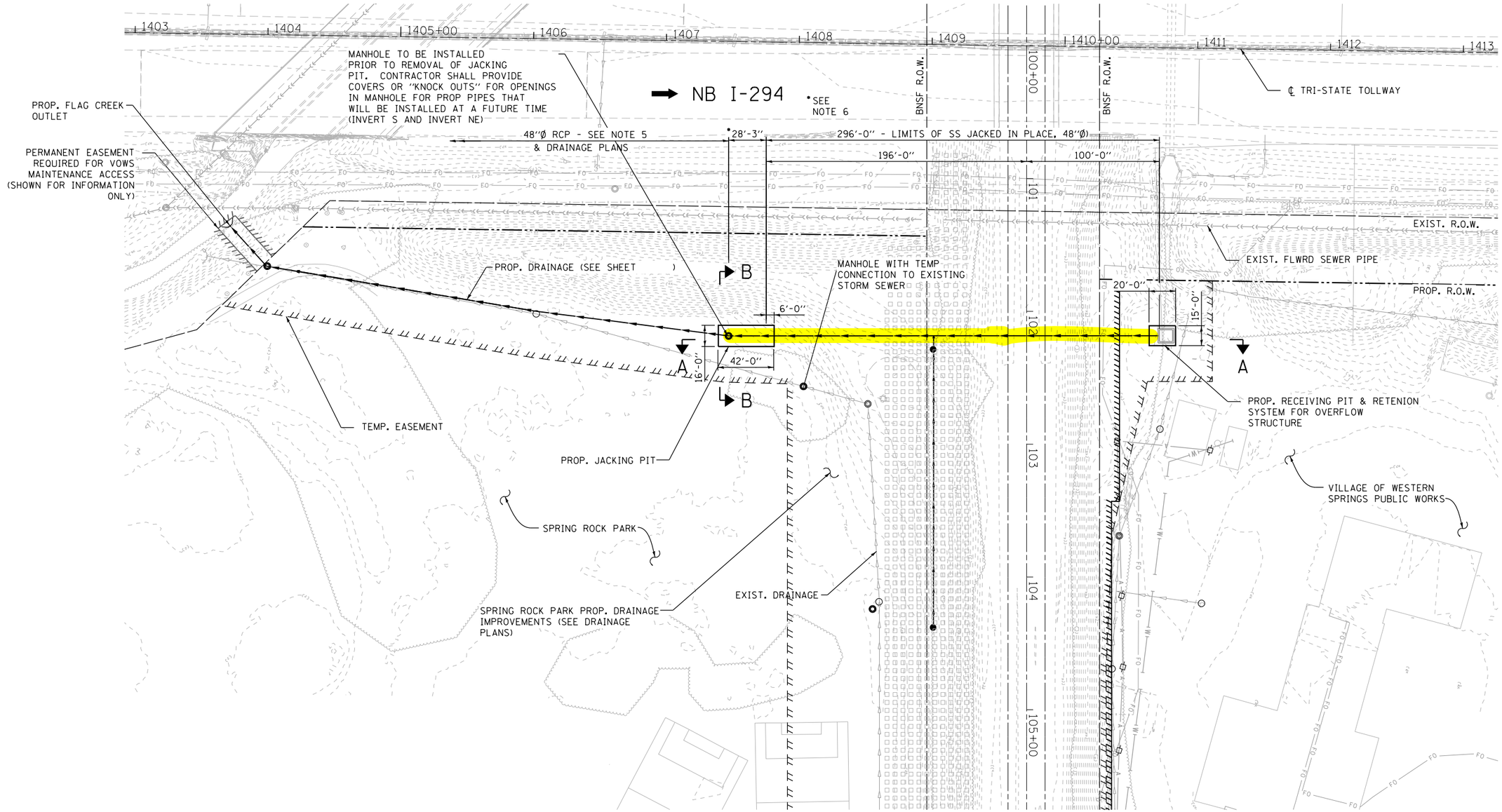
In order for cost-sharing to be considered, the project must have a state or local government sponsor, i.e., a unit of government with the authority to levy taxes. This includes general-purpose units of local governments (e.g. cities, counties and townships) as well as specialized governing districts (e.g. sanitary districts, school districts, forest preserve districts, park districts, airport authorities and publicly owned universities or colleges). The local agency sponsor must commit to providing, at a minimum, the difference between the adjusted allowable cost for noise abatement and the actual barrier cost for the respective receptor location (e.g. if the adjusted allowable cost is $35,000 per benefited receptor and the actual barrier cost is $40,000 per benefited receptor, the local agency sponsor would be responsible for $5,000 per benefited receptor).

7.0 Traffic Noise Abatement Techniques

Means and methods for implementation of traffic noise abatement shall be considered based on effectiveness of traffic noise attenuation and reasonableness of cost.

- **Noise Walls**: Noise walls are solid structures built between the highway and the noise sensitive receptors along the roadway. Noise walls are typically constructed of precast concrete panels, cast-in-place concrete, concrete masonry blocks, masonry or wood. Absorptive surfaces will also be considered in areas where noise sensitive receptors may be affected by reflected noise on either side of the wall, or in instances where wall heights can be reduced to provide comparable effectiveness. Noise walls can reduce traffic noise levels effectively.
- **Earth Berms**: Traffic noise barriers can be formed from earth mounds along the road typically called earth berms. Earth berms have a natural appearance and offer opportunities for landscaping; however, earth berms can require a considerable width across land to accommodate the height necessary to provide the amount of noise reduction required.
- **Vegetation**: If high enough, wide enough, deep enough and dense enough (cannot be seen through), vegetation can decrease the highway traffic noise at a noise sensitive receptor. A 200-foot thickness of effective dense vegetation can reduce noise by 10 dB(A), which can cut the noise volume in half. It is often impractical to plant enough dense vegetation along a road to achieve such reductions; however, if dense vegetation is already present, possibilities exist where it could be saved with some noise reductions achieved.
- **Encouraging Compatible Adjacent Land Use**: Traffic noise compatible land use planning is a community planning method and proactive responsibility that helps reduce or eliminate traffic noise levels at noise sensitive receptors along roadways. This type of planning means considering land use options and traffic noise issues more effectively so that compatible developments are set up next to the Tollway. Municipalities and counties have the power to encourage traffic noise compatible land use planning by developing effective land use plans, zoning or other legal means (such as subdivision or development standards, building or housing regulations), land or easement purchases and community education to inform citizens, developers and local planners about traffic noise compatible land use planning.
- **Promote Tollway Policy and Encourage Local Governments**: The Tollway encourages those who plan and develop land, and local governments controlling development or planning land use near existing or planned Tollway locations, to exercise their powers and responsibility to minimize the effect of roadway traffic noise on future sensitive receptors through appropriate land use control. Where such land use controls are not in place, municipalities, townships and counties may not be eligible for traffic noise abatement consideration for sensitive receptors by the Tollway.
- **Reduction of Traffic Noise at the Source**: Reduction of traffic noise impacts by design or treatment of the road surface is the most cost-effective traffic noise control available to the Tollway. Within the group of traffic noise abatement methods that are feasible and reasonable, and after life-cycle cost analysis have selected a pavement type and other technical and financial constraints, the Tollway will use the quietest surface texture available when repaving or reconstructing a roadway in traffic noise sensitive areas.

- **Traffic Noise Abatement by Others**: All future planned developments adjacent to the Tollway should include a provision in the Subdivision Plat approval requirements that mandates the developer to place a covenant running with the land notifying perspective purchasers that traffic noise abatement will not be provided by the Tollway. The Tollway encourages developers and local governments to coordinate their efforts to mitigate roadway traffic noise. This must be done without encroachment on the Tollway ROW, unless it is determined to be necessary, and authority is granted to permit others to construct a sound barrier, berm or landscape in the Tollway's ROW. The design must meet the Tollway's geometric, structural, safety and maintenance standards. The Tollway shall assume no liability review authority or responsibility of any kind for the structural integrity or acoustical effectiveness of traffic noise abatement sound barriers constructed by others.



PLAN

LEGEND

- GROUND IMPROVEMENT
- FO — EXIST. UNDERGROUND FIBER OPTIC CABLE
- PROP. STORM SEWER
- EXIST. STORM SEWER
- EXIST. TOLLWAY ROW
- PROP. TOLLWAY ROW

NOTES

1. CONTRACTOR SHALL LOCATE EXISTING UTILITIES PRIOR TO INSTALLING EXCAVATION SUPPORT, AND MAKE NECESSARY ADJUSTMENTS TO AVOID CONFLICTS AS APPROVED BY THE ENGINEER.
2. CONTRACTOR SHALL COORDINATE THIS WORK WITH THE PROPOSED DRAINAGE ELEMENTS, TIMBER PILE IPROVEMENTS, AND FIBER OPTIC UTILITIES.
3. CONTRACTOR SHALL SUBMIT AN EROSION CONTROL AND DEWATERING PLAN TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCING JACKING OPERATIONS. SEE SPECIAL PROVISIONS.
4. FOR SECTIONS & DETAILS SEE SHEET $DPJ02$.
5. THIS SEGMENT OF PIPE SHALL BE INSTALLATED AFTER THE HILLGROVE AVE PIPE IS INSTALLED. IN ADDITION, THIS WORK SHALL BE PERFORMED BETWEEN NOVEMBER 1 AND MARCH 1 AND COORDINATED WITH THE WESTERN SPRINGS PARK DISTRICT.
6. INSTALL THIS SEGMENT OF PIPE PRIOR TO REMOVAL OF JAKCING PIT

DRAWN BY LAM	SCALE	Gannett Fleming	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY 2700 OGDEN AVENUE DOWNERS GROVE, ILLINOIS 60515
CHECKED BY DF	DATE $DATE		

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

PIPE JACKING LAYOUT

SHEET NO. $DPJ01$

DRAWING NO. $DPJ01 OF $TOT

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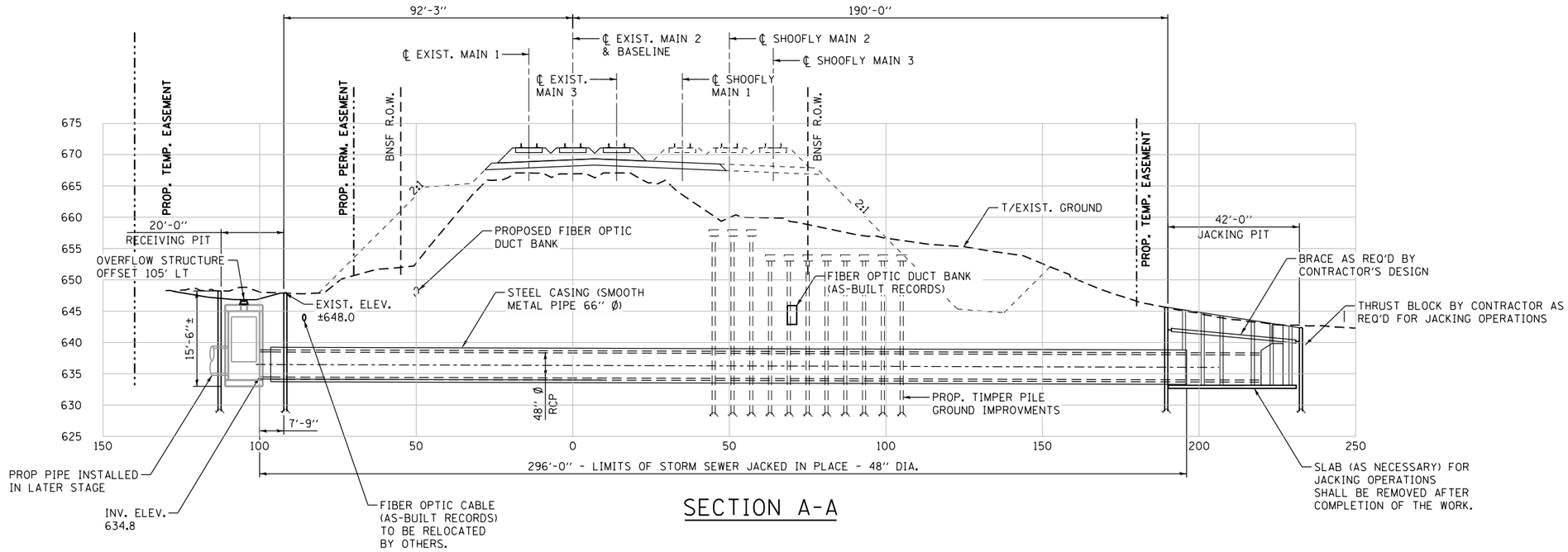
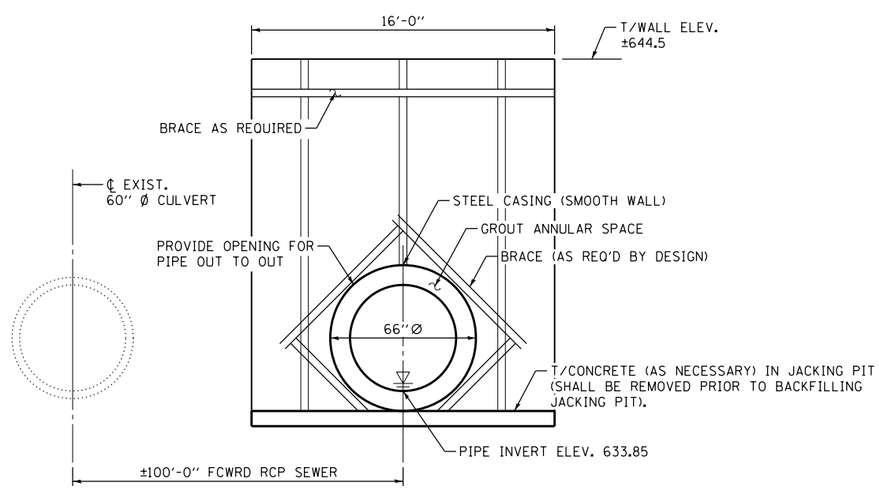


SECTION A-A



SECTION B-B

(JACKING PIT SHOWN,
RECEIVING PIT SIMILAR)

BILL OF MATERIAL

PAY ITEM	DESCRIPTION	UNIT	QUANTITY	RECORD QUANTITY
X1200080	STORM SEWERS JACKED IN PLACE, 48"	FOOT	296	

EXCESS SOIL EXCAVATED FOR JACKING PIT, RECEIVING PIT, AND PIPE INSTALLATION SHALL BE DISPOSED OF AS NON-SPECIAL WASTE, ACCORDING TO THE STANDARD SPECIFICATIONS. STRUCTURE EXCAVATION IS NOT MEASURED FOR PAYMENT FOR THIS WORK OR THE OVERFLOW STRUCTURE, AND THE DISPOSAL OF EXCESS MATERIAL IS NOT MEASURED FOR PAYMENT SEPARATELY, BUT THIS WORK SHALL BE INCLUDED IN THE COST OF STORM SEWERS JACKED IN PLACE.

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Gannett Fleming

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS

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CONTRACT NO. I-18-4428

PIPE JACKING DETAILS

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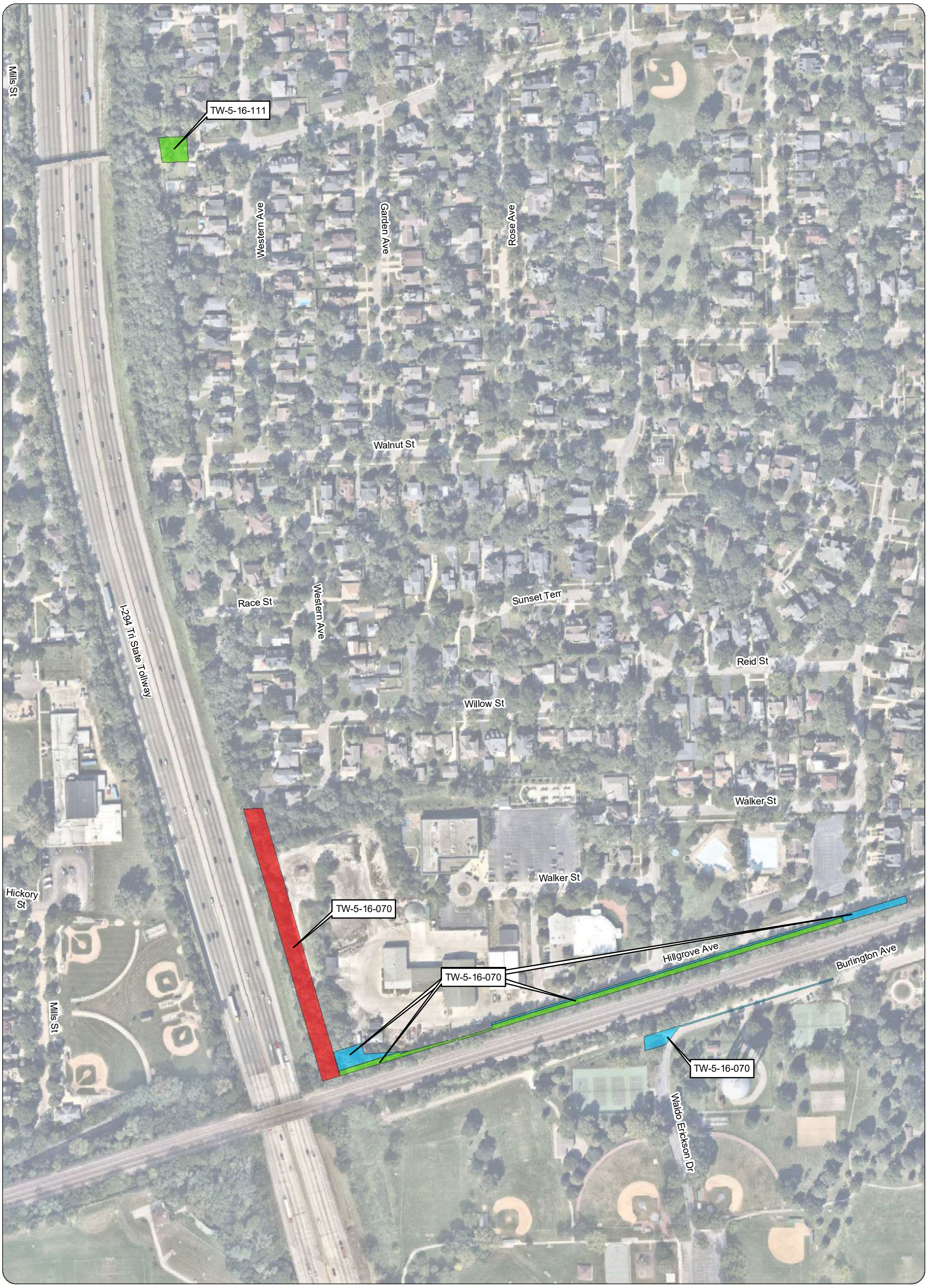

Central Tri-State Project
02/26/2018

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Proposed Acquisition Type

- Temporary Easement
- Permanent Easement
- Fee

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Project Segment:

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Land Acquisition Plan
The Village of Western Springs
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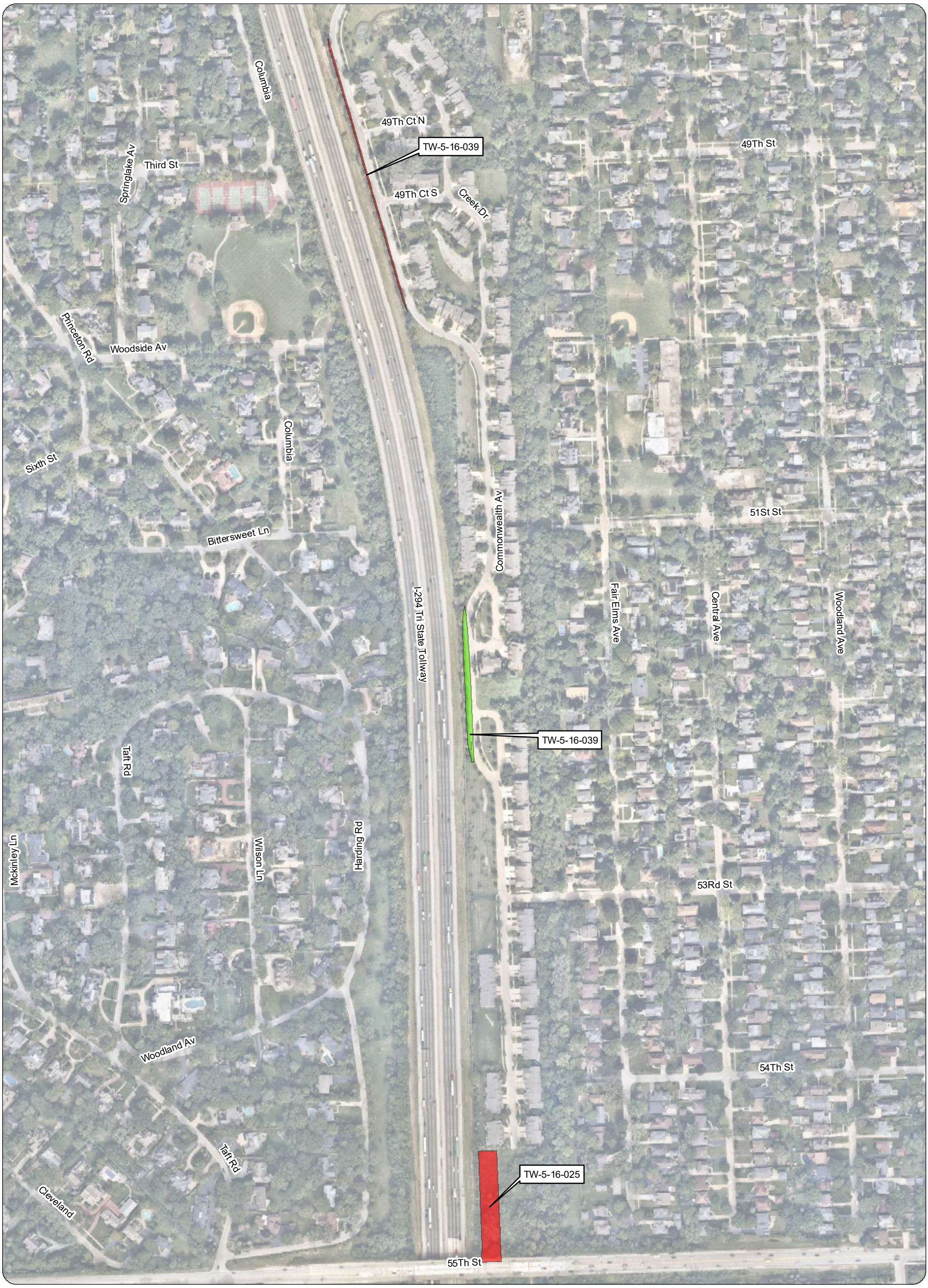

Central Tri-State Project
02/26/2018

Legend

Proposed Acquisition Type

- Temporary Easement
- Permanent Easement
- Fee

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Project Segment:

Tri-State
Land Acquisition Plan
The Village of Western Springs
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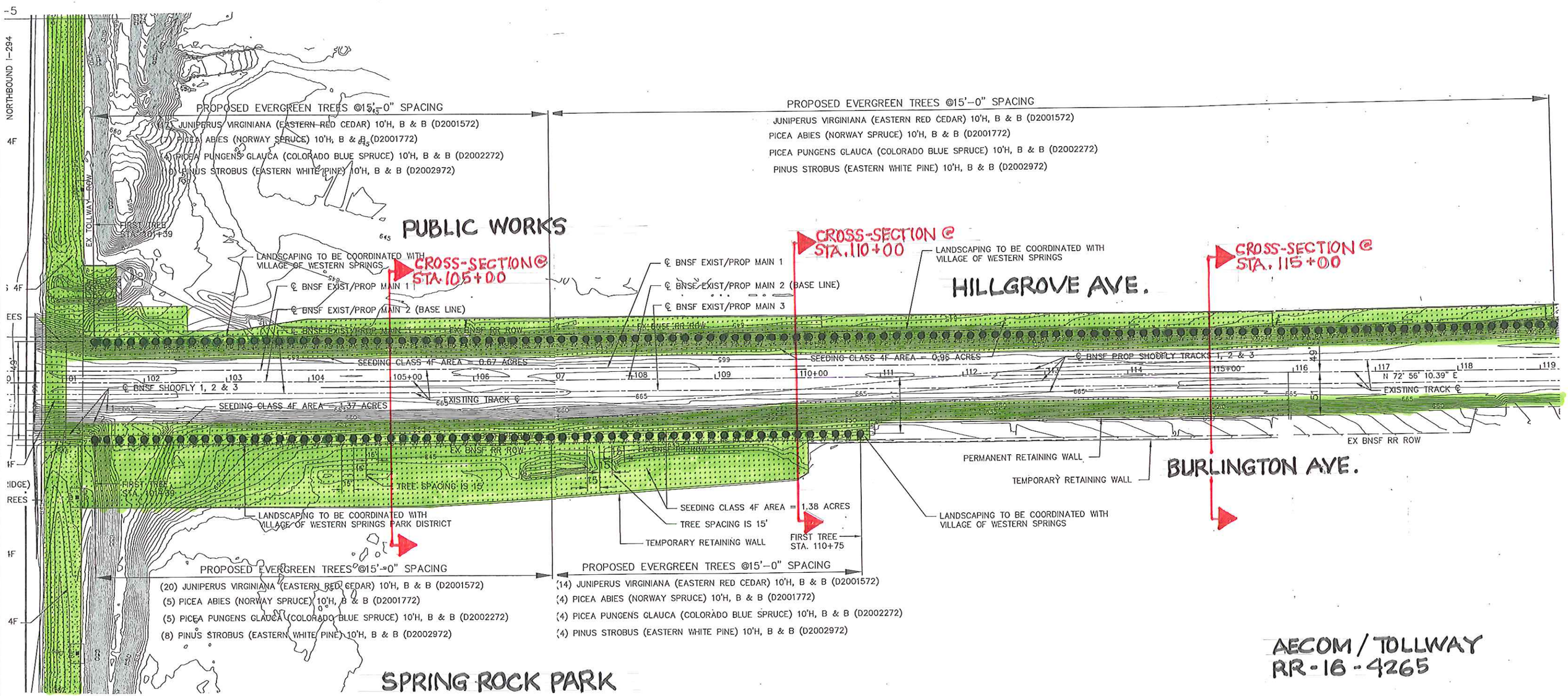

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PLAN VIEW ALONG WESTERN SPRINGS - STA. 101+00 TO 119+00

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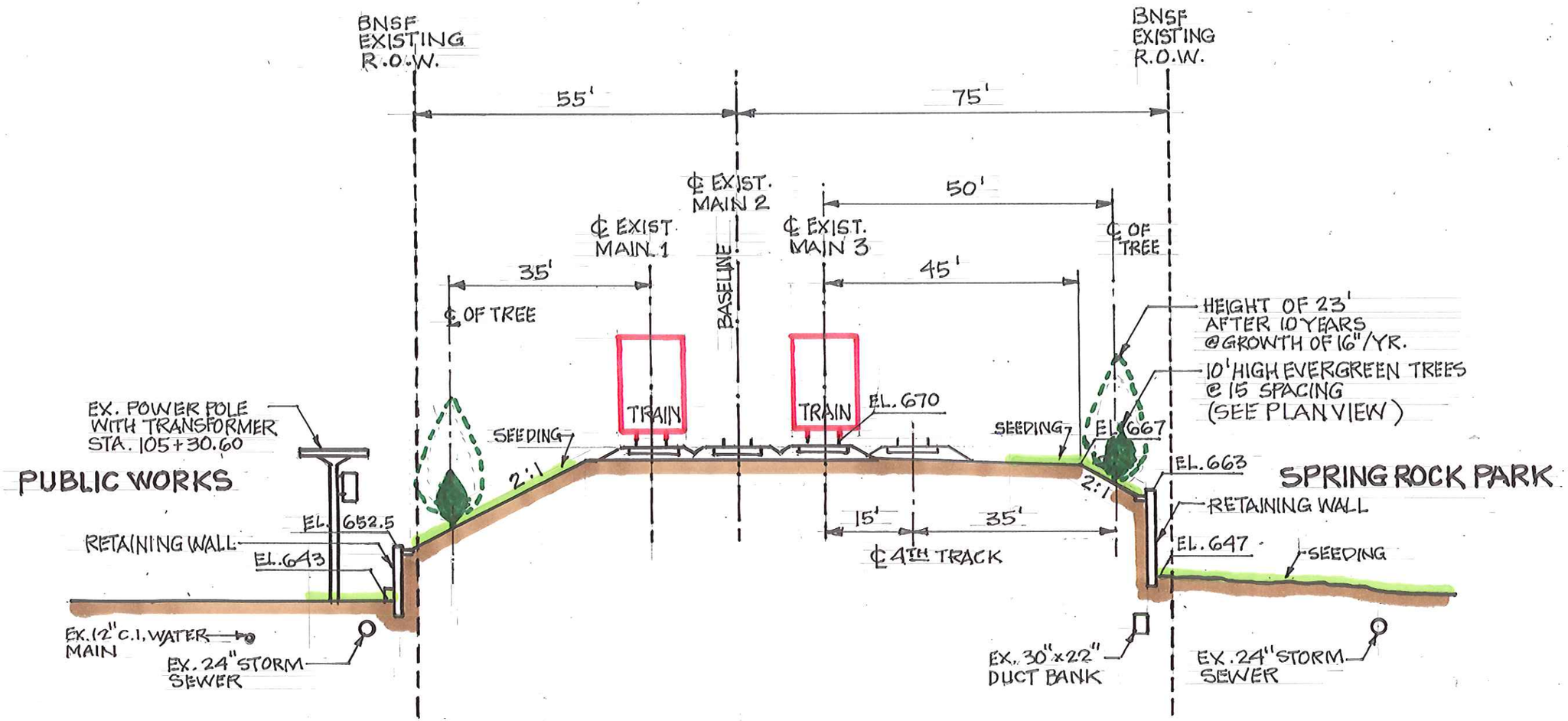

CROSS-SECTION @ STA. 105+00

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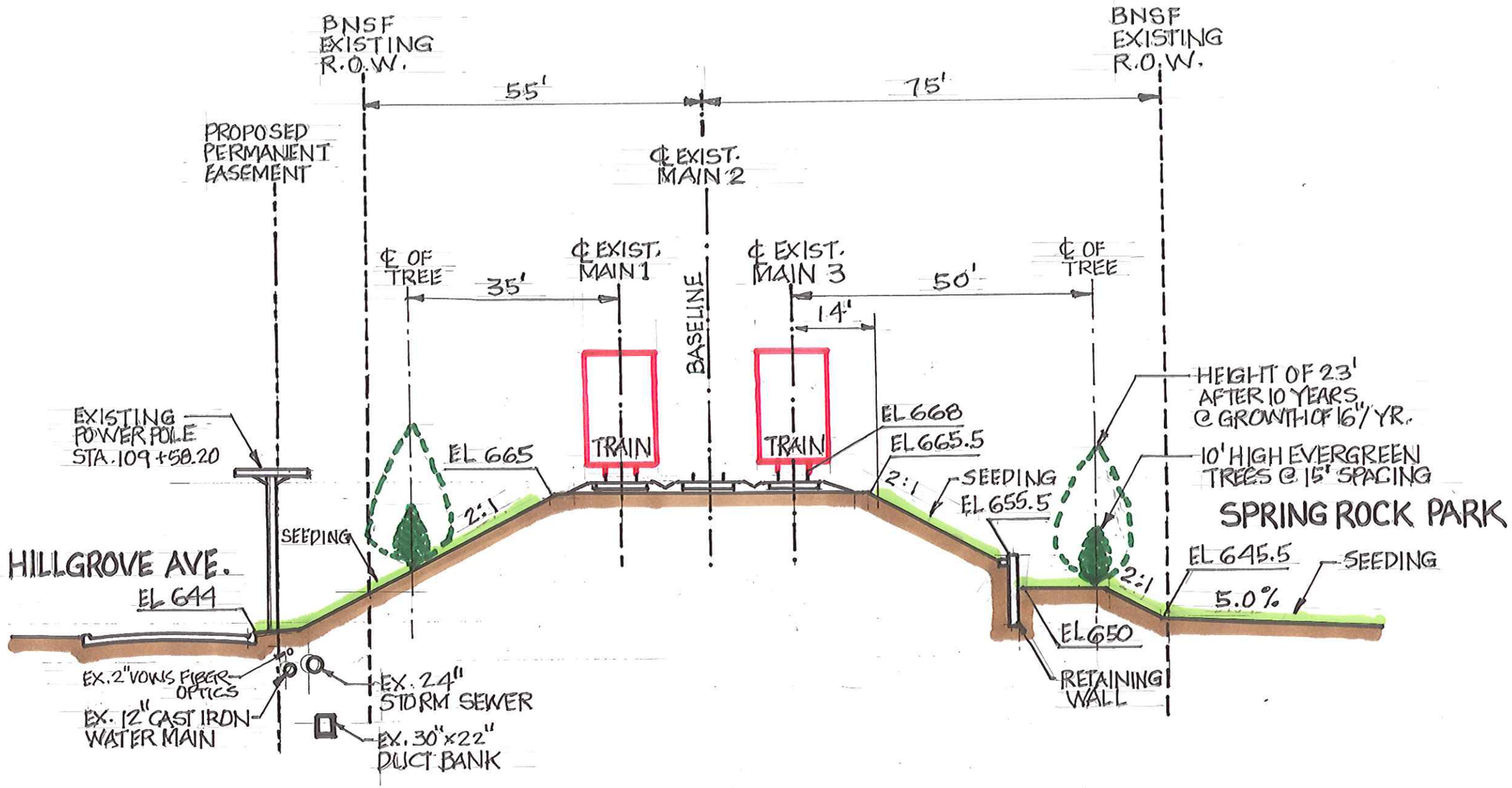

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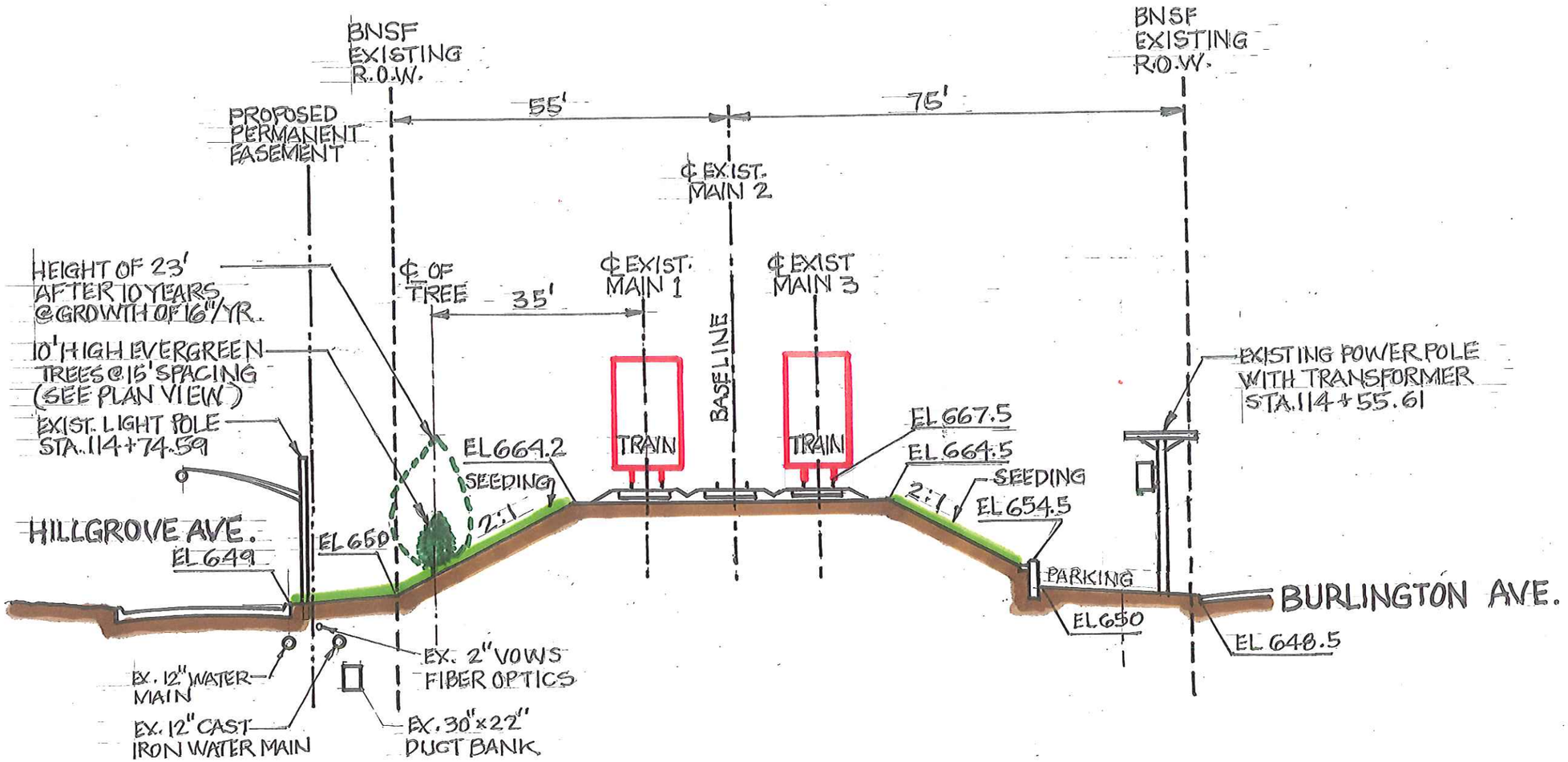

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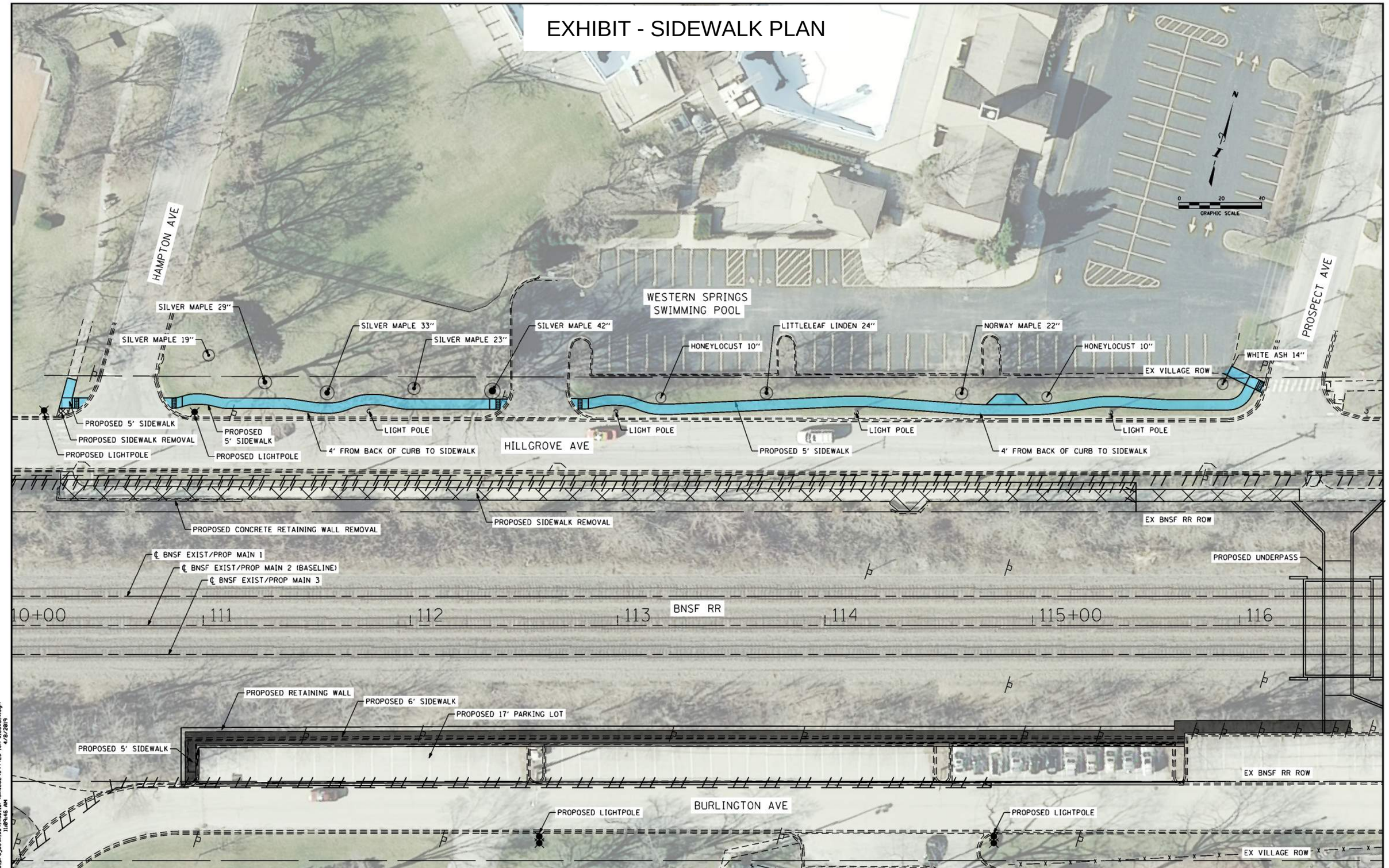
EXHIBIT - SIDEWALK PLAN



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EFK•Moen, LLC
Civil Engineering Design
311 South Wacker Dr, Suite 400
Chicago, IL 60606
Phone 312-396-4065

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

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VILLAGE OF WESTERN SPRINGS
PROPOSED ROADWAY PLAN EXHIBIT

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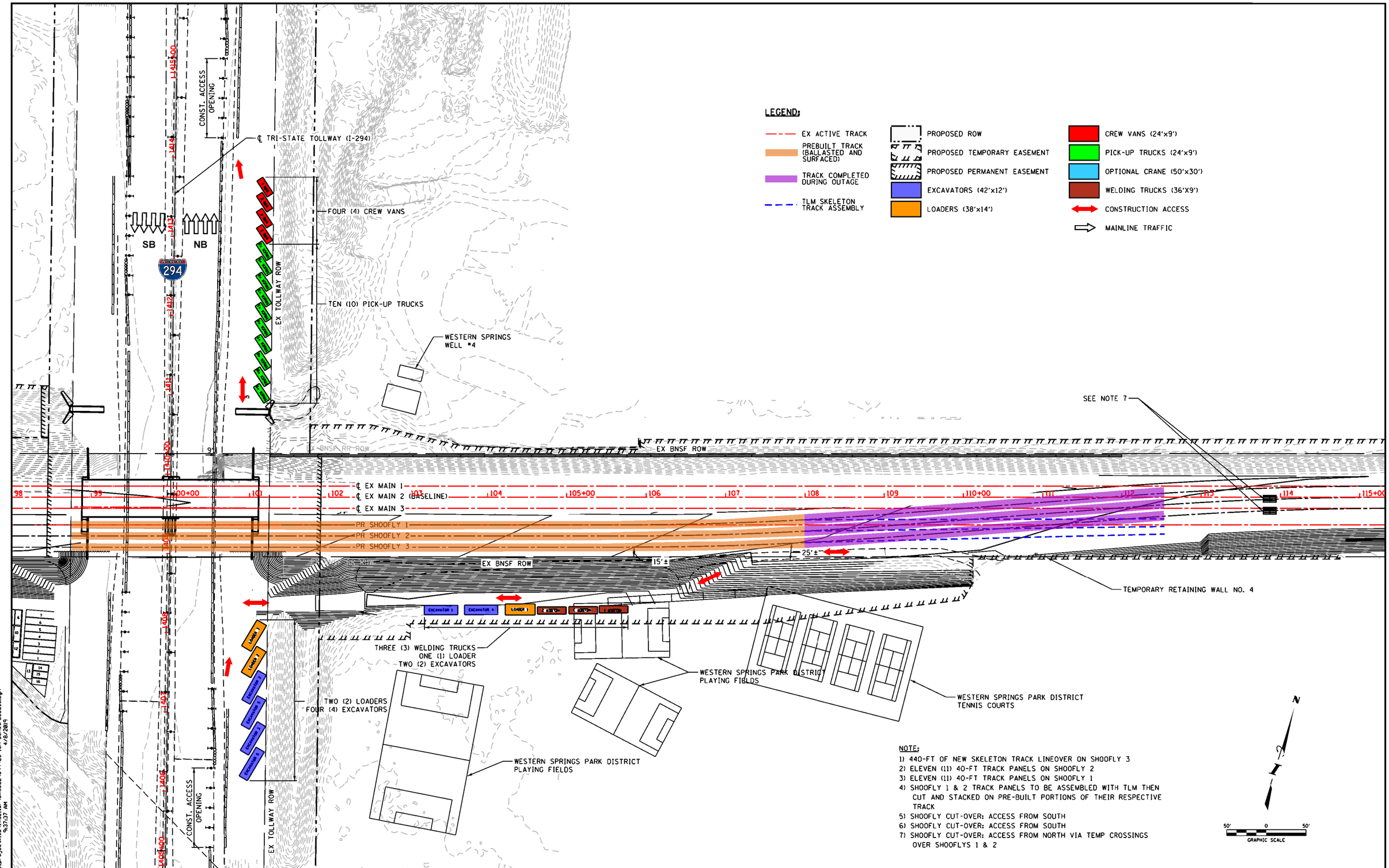

NOTE:

1) 440-FT OF NEW SKELETON TRACK LINEOVER ON SHOOFLY 3
2) ELEVEN (11) 40-FT TRACK PANELS ON SHOOFLY 2
3) ELEVEN (11) 40-FT TRACK PANELS ON SHOOFLY 1
4) SHOOFLY 1 & 2 TRACK PANELS TO BE ASSEMBLED WITH TLM THEN CUT AND STACKED ON PRE-BUILT PORTIONS OF THEIR RESPECTIVE TRACK
5) SHOOFLY CUT-OVER: ACCESS FROM SOUTH
6) SHOOFLY CUT-OVER: ACCESS FROM SOUTH
7) SHOOFLY CUT-OVER: ACCESS FROM NORTH VIA TEMP CROSSINGS OVER SHOOFLYS 1 & 2

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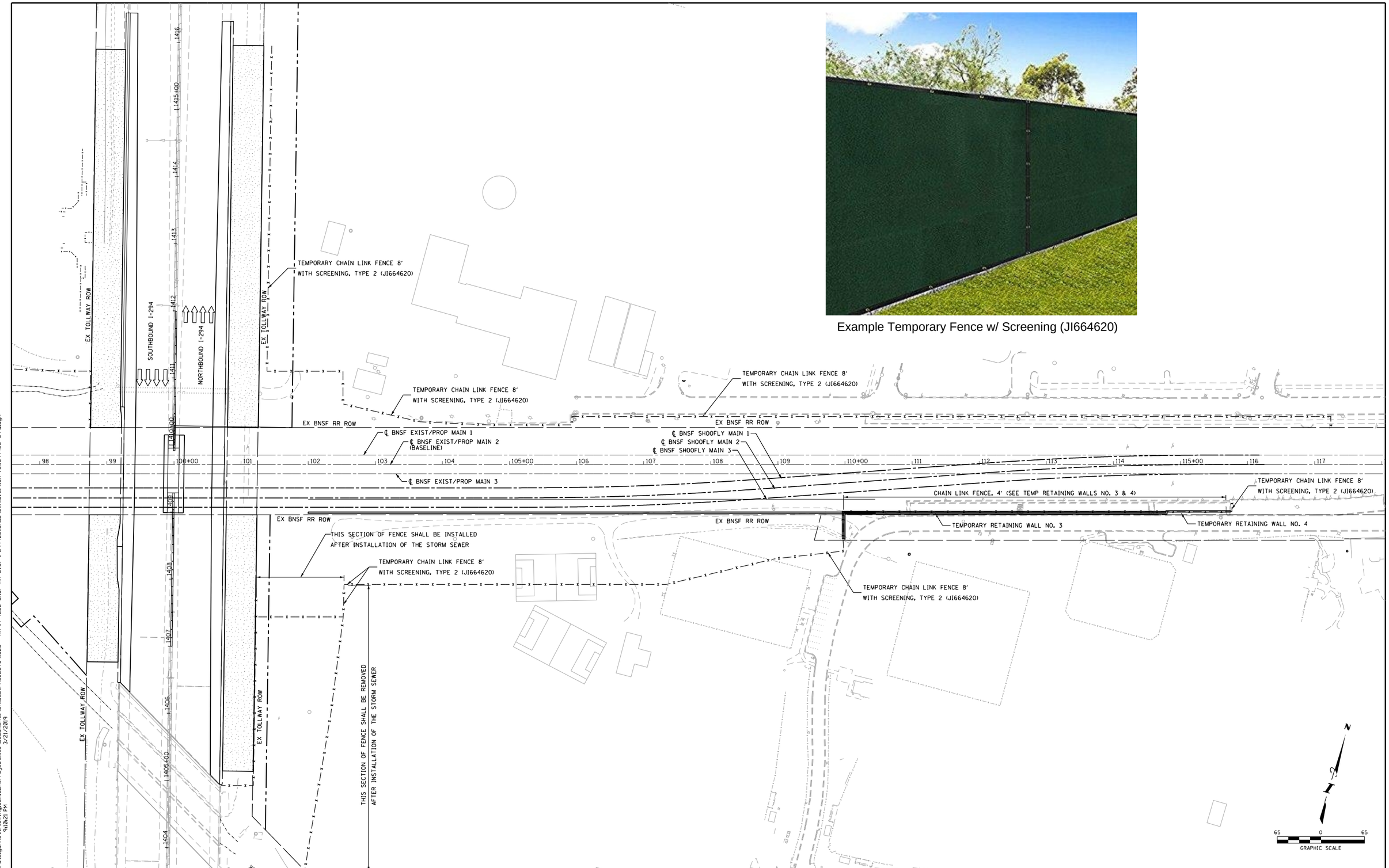

Example Temporary Fence w/ Screening (JI664620)

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2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

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CONTRACT NO. I-18-4428

TEMPORARY SITE FENCING PLAN

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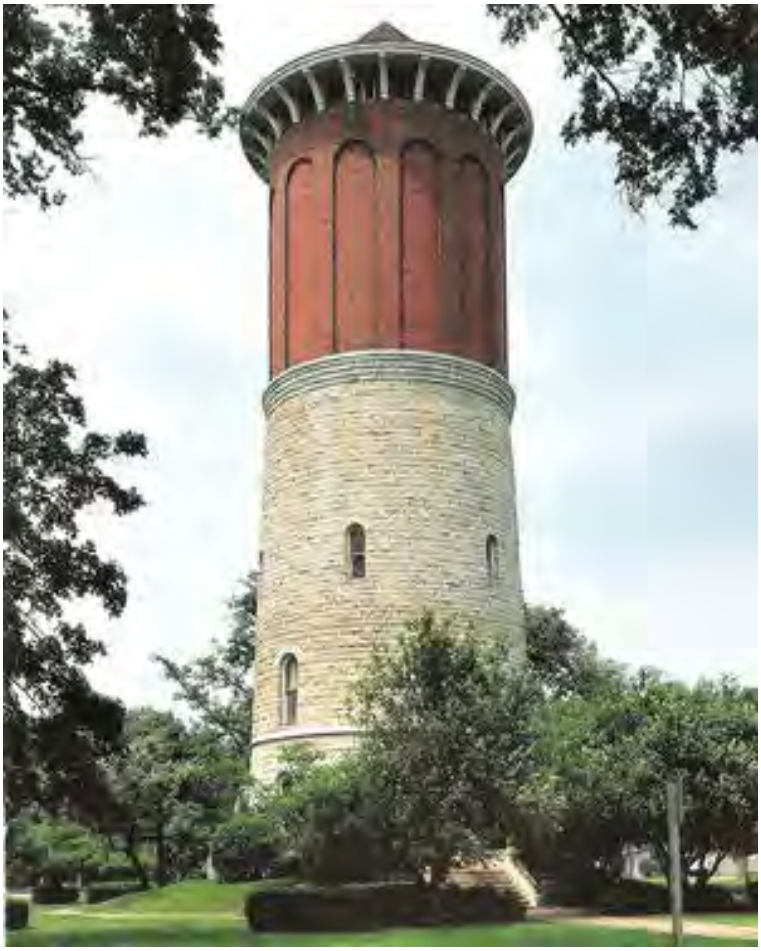
Village of Western Springs Water Supply

Modified Groundwater Protection Needs Assessment

for the

Proposed BSNF Rail I-294 Bridge Reconstruction



By: V3 Companies, Ltd
&
Wang Engineering

For: The Illinois Tollway

March 2019

Image: Western Springs Historical Society

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Appendix E Western Springs Water System Information

1.0 EXECUTIVE SUMMARY

The portion of the Illinois State Toll Highway Authority I-294 (Illinois Tollway) that is just west of certain Village of Western Springs (Western Springs) assets will be improved in the near future. The proposed improvements include reconstruction of a retaining wall along the east side of the BNSF rail bridge crossing I-294, which will occur within the minimum setback distance of 200 feet (minimum setback zone) for Western Springs' community **Well #4**.

The Village of Western Springs requested that the Toll Authority complete a Groundwater Protection Needs Assessment (GPNA) to provide a comprehensive evaluation of the groundwater protection measures necessary in order to assure the supply of potable water is not susceptible to contamination. The discussions herein are provided in response to the Village's request by providing a GPNA focused on the planned BNSF bridge reconstruction.

For purposes of assessing potential impacts from retaining wall construction activities, the area of focus is generally limited to the west/southwest direction from **Well #4**, while the broader Study Area is best defined as a 1000 feet radius around **Well #4**. It is important to note that the scope of a GPNA focuses on the risk of contamination to the groundwater and water infrastructure. While any potential physical or security risk from nearby construction and development are outside of the typical scope of a GPNA, some related commentary is provided. However, recommendations for typical and appropriate monitoring measures during construction (i.e., during the driving of piles and similar activities) should be obtained from others.

Western Springs' municipal drinking water is sourced completely from groundwater wells. **Wells #1**, **#3**, and #4 are managed by the Village. The range of Western Springs' water consumption is approximately 1.2-2.8 MGD. Groundwater is pumped from **Well #3** and **Well #4**, treated and/or stored in a reservoir prior to pumping into the Village water tower and to the consumer. In general, well system reconditioning is done about every 10-15 years. The reconditioning typically involves the well pipe, inspection and reconditioning of the pump well and motor, and inspection of the well shaft.

Well #4 was originally drilled to an approximate depth of 1910 feet. The hole was cased to a depth of approximately 839 feet, and was open to and drawing water from the Ironton-Galesville and Mt. Simon sandstones. In 1991, the botton of the well was filled in to approximately 1482 feet to block off the Mt. Simon, leaving it open only to the Ironton-Galesville (Baxter & Woodman, 2018). Consequently, the primary aquifer of interest for this modified GPNA is the Ironton-Galesville.

The geologic and hydrogeologic review and evaluations provided herein indicate that the Ironton-Galesville is separated from overlying shallow bedrock units and the unconsolidated glacial deposits by a series of confining units, most notably:

- Wedron Group / Wadsworth Formation – clayey diamicton (glacial till) in excess of 25 feet thick in the area immediately surrounding **Well #4**;
- Maquoketa Group – mostly impermeable shales in excess of 100 feet thick in the area of **Well #4**.

The lower confining unit separating the Ironton-Galesville from the saline Mt. Simon is the:

- Eau Claire Formation – predominantly impermeable shales, dolomite, and dolomitic limestone in the upper and middle portions of the formation often in excess 300 feet in thickness.

Further, **Well #4** is cemented and cased with 20" diameter blank casing to 839 feet in depth (**Figure 20**), leaving the well drawing water from only the Ironton-Galesville aquifer.

As a consequence of the aforementioned presence of aquitards and well construction, **Well #4** and aquifer of primary interest are not considered vulnerable or typically susceptible to downward migration of the contaminants from near surface sources of contaminates.

Aquifer impact risks posed by the BNSF bridge reconstruction project are minimal. The aquifer of interest, the Ironton-Galesville, is a deep bedrock system located greater than 1000 feet in depth, isolated by confining units. The depth of construction is typically limited to 15 feet or less below grade, which would occur within an aquitard (Wedron Group clays). Further, the anticipated construction activities do not represent primary or secondary potential sources of contamination. Consequently, the greatest construction risks include compromising the integrity of the well head and well bore seal/ casing and/or physical damage to the related water infrastructure, including the transmission main.

While some temporary storage of petroleum products and chemicals may occur during construction, the location and conduct of these more sensitive activities can be managed through spill plans and best management practices.

The anticipated BNSF bridge reconstruction activities are not unusual or particularly intrusive in their nature or compromising in their proximity to sensitive infrastructure (**Section 6.3**). While beyond the scope of a GPNA, V3 understands the Village of Western Springs expressed concerns with nearby construction activities as a potential, physical risk to the well and its operation. Although these activities do not impact the ground water quality, precautions will be taken, as appropriate, including vibration and settlement monitoring during construction and will be prepared and reviewed with The Village outside of this report. **(Section 7.0).**

The results of this GPNA suggest the existing minimum well setback zone of 200' provides adequate protection for Western Springs community **Well #4**. The BNSF bridge reconstruction project includes construction elements that occur within the 200' setback. However, these activities are of temporary duration and do not represent regulated contamination sources.

2.0 PROJECT BASIS

The portion of the Illinois State Toll Highway Authority I-294 (Illinois Tollway) that is just west of certain Village of Western Springs (Western Springs) assets will be improved in the near future. The proposed improvements include reconstruction of a retaining wall along the east side of the BNSF rail bridge crossing I-294. More specifically, construction activities, including construction of the proposed retaining wall, will occur within the minimum setback distance of 200 feet (minimum setback zone) for Western Springs' community **Well #4** used for potable water as described more fully below.

The 200 feet minimum setback zone (from any potential sources of, or routes for, contamination) for **Well #4** is identified in the Village of Western Springs' *Source Water Assessment Program* (SWAP). **Figure 1** (below) depicts the 200 feet radius representing the minimum well setback zone, as well as the 1,000 feet radius that represents the Study Area utilized herein.

Western Springs' SWAP is consistent with Section 14.2 of the *Illinois Groundwater Protection Act* (IGPA), 415 ILCS 5/14.2. The IGPA, enacted in 1987, establishes a comprehensive program for the protection of groundwaters in Illinois. Section 14.2 establishes the minimum setback zones for wellhead protection:

> *(a) …no new potential route or potential primary source or potential secondary source may be placed within 200 feet of any existing or permitted community water supply well or other potable water supply well (415 ILCS 5/14.2(a)).*

The SWAP indicates that **Well #4** is a deep well drilled in 1966 and completed in the Mt. Simon formation approximately 1,900 feet below ground surface (bgs). The well was rehabilitated in 2010, 1998 and 1990. **Well #4** is not considered geologically sensitive.

As part of the Tollway I-294 improvement plans, a request was submitted to Western Springs requesting a standard monitoring and protection plan for **Well #4** that would be applicable during improvement activities on the BNSF bridge section. Western Springs responded to this request by letter dated November 10, 2017 indicating that additional information is required before comprehensive protective measures can be recommended. The letter states in part:

> *While the bridge construction activities fall outside of the 200-foot setback, other construction activities are anticipated to take place near the Village's well and transmission line. The Village is requesting the following requirements pertaining to a well and potable water supply protection plan for this water facility.*
>
> ***Completion of a Groundwater Protection Needs Assessment (GPNA)***
>
> *The Village is requesting the Toll Authority complete a GPNA to provide a comprehensive evaluation of the groundwater protection measures necessary in order to assure the supply of potable water is not susceptible to contamination….*
>
> *The Village has provided the IEPA's Guidance Document for Groundwater Protection Needs Assessment ("Guidance").*

The IEPA Guidance states that a GPNA may not be warranted under various circumstances, some of which may be applicable here. V3 has not been consulted regarding the applicability of a GPNA and provides this Report as a "modified" GPNA to address the applicable provisions of the Guidance.

For purposes of assessing potential impacts from retaining wall construction activities, the area of focus has been limited to the southwest, south and southeast directions from **Well #4**. The general outline of

the reconstruction area is shown on **Figure 1**. A more detailed depiction of the planned construction is shown in **Figure 2**.

Figure 1- Project Location

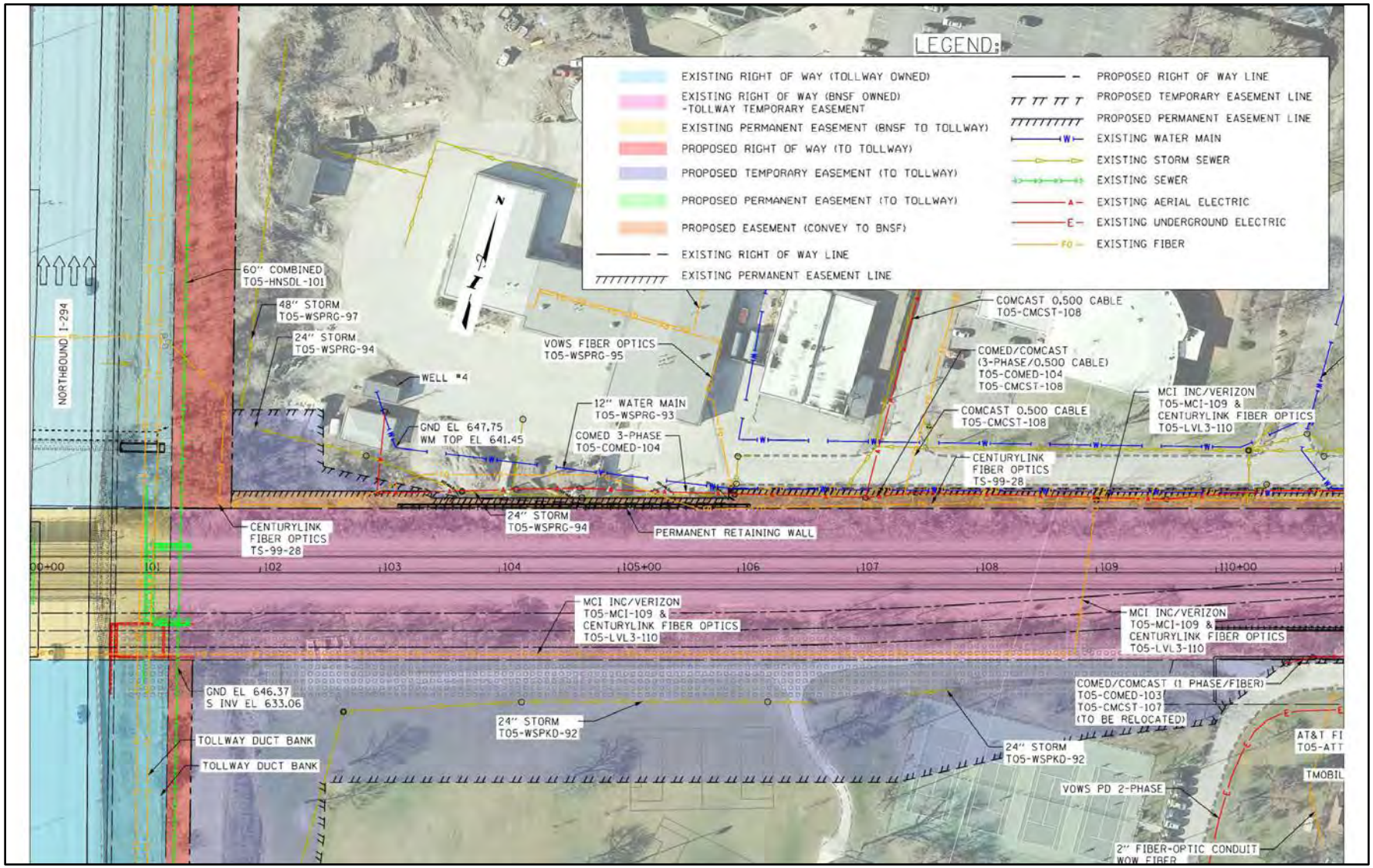


Figure 2- Proposed BNSF Rail Reconstruction (Bowman, Barrett & Associates, Inc., 2019)

2.1 PROPOSED BNSF RAIL BRIDGE RECONSTRUCTION

In order to accommodate an increased roadway width of I-294, the Tollway is lengthening the BNSF Railroad Bridge. The proposed bridge reconstruction will generally occur to the southwest and south of **Well #4**, but will also include related construction activities to the southeast. A map of the railroad, roadway, utilities, and proposed easements and right of way are shown on **Figure 2**.

Appendix A contains a larger drawing of the construction area along with relevant cross-sections (Bowman, Barrett & Associates, Inc., 2019). The bridge reconstruction to the east of I-294 will require the construction of a temporary shoofly bridge and two permanent retaining walls, as discussed in the following sections.

2.1.1 TEMPORARY SHOOFLY CONSTRUCTION

The BNSF Railroad Bridge holds a triple track railroad that passes over I-294 and runs between the municipalities of Hinsdale and Western Springs. Freight traffic over the bridge must be temporarily accommodated by a shoofly, or bypass, bridge to be constructed to the south of the current bridge while the main bridge is being reconstructed.

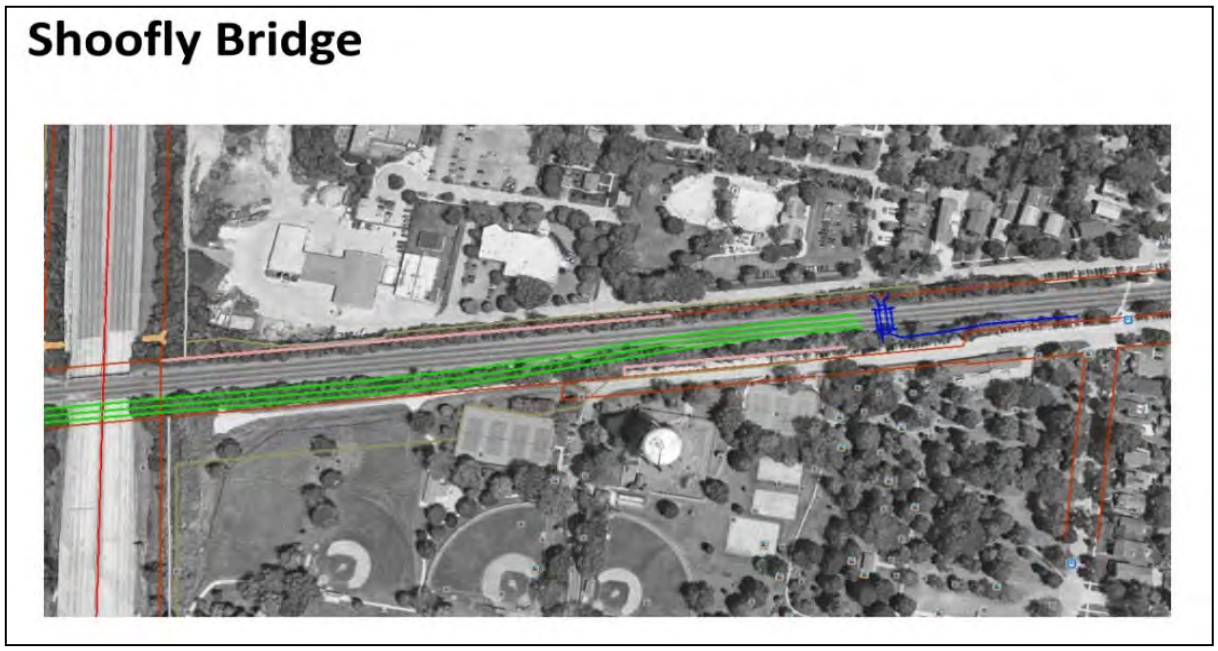


Figure 3- Shoofly Bridge (Zucchero, 2018)

2.1.2 FINAL BRIDGE CONSTRUCTION

The final bridge embankment condition will require two permanent retaining walls, one wall (**Wall #2**) will be located along the south side of the embankment between approximate Stations 110+00 and 115+50, offset 50 feet right. The second retaining wall, hereafter referred to as proposed retaining wall #1, will be located within the 200 feet setback of **Well #4** from approximate Stations 103+15 to 106+10.

Proposed retaining wall #1 is a drilled soldier pile wall along the north side of the right of way for the BNSF railroad for a total length of 295’ with an averaged exposed height of 5.1 feet. The piles will be placed at between 7’-0” and 9’-0” in 30” diameter drilled shafts to an elevation of 629.0. The average depth of pile is 15 feet below existing ground. Wood lagging will be used between the pilings until the

permanent cast in placed concrete facing is installed. The calculated distance from the well house #4 (**Well #4**) to the nearest shaft is 86 feet.

A Western Springs water main (identified as 12" Water Main, T05-WSPRG-93 in **Figure 2** and **Appendix A**) is located to the north and is within approximately 50 feet (Station 103+15) to 14 feet (Station 106+15) of proposed retaining wall #1.

2.1.3 CONSTRUCTION EASEMENTS

Proposed rights of way, permanent easements and temporary construction easements for the reconstruction are depicted in **Figure 2** and **Appendix A**.

2.2 WESTERN SPRINGS WATER SYSTEM

The three Western Springs community wells (wells #1, #3 and #4) are all located within 0.75 miles of each other near the BNSF rail lines (see **Figure 4** below).

The wells are connected through a system of water mains to distribute water throughout the Village. The water mains typically run parallel to the rail lines. As previously discussed, the water main that connects to **Well #4** within the BSNF bridge reconstruction area is a 12-inch diameter line (12" Water Main, T05-WSPRG-93). Refer to **Figure 2** and **Figure 4** (below).

The following sections summarize general information for the water system. Additional information is provided in the *Water Study Report* (Water Study Group, undated excerpts) and the Village of Western Springs – Well Nos. 3 and 4 Interference Test (Baxter & Woodman, 2018) provided in **Appendix E**.

2.2.1 PUBLIC WATER SUPPLY WELLS

Western Springs' municipal drinking water is sourced completely from groundwater wells. Wells #1, #3, and #4 are managed by the Village.

Well #3 is completed to a depth of 1600 feet and draws water from the Galesville aquifer and **Well #4** was originally completed to a depth of is completed to a depth of 1910 feet, and originally drew water from the Galesville and Mt. Simon aquifers (**Section 3.3**). **Well #1** is a shallow well, originally completed to a depth of 385 feet and, as a consequence of water system constraints, is typically used for emergency purposes only. The range of Western Springs' water consumption is approximately 1.2-2.8 MGD.

The following table provides a summary of each community well, related water delivery capacities, and general water quality.

	Date	Depth (ft.)	Rate (GPM)	Capacity (MGD)	Iron (mg/L)	Hardness (mg/L)	Radium (pCi/L)
Well #1	1924	385	780	1.123	1.72	1013	2.35
Well #3	1955	1613	1150	1.656	0.207	283	10.32
Well #4	1966	1901	1025	1.476	0.319	189	4.73

Table 1- Western Springs Water Well Data (Village of Western Springs website)

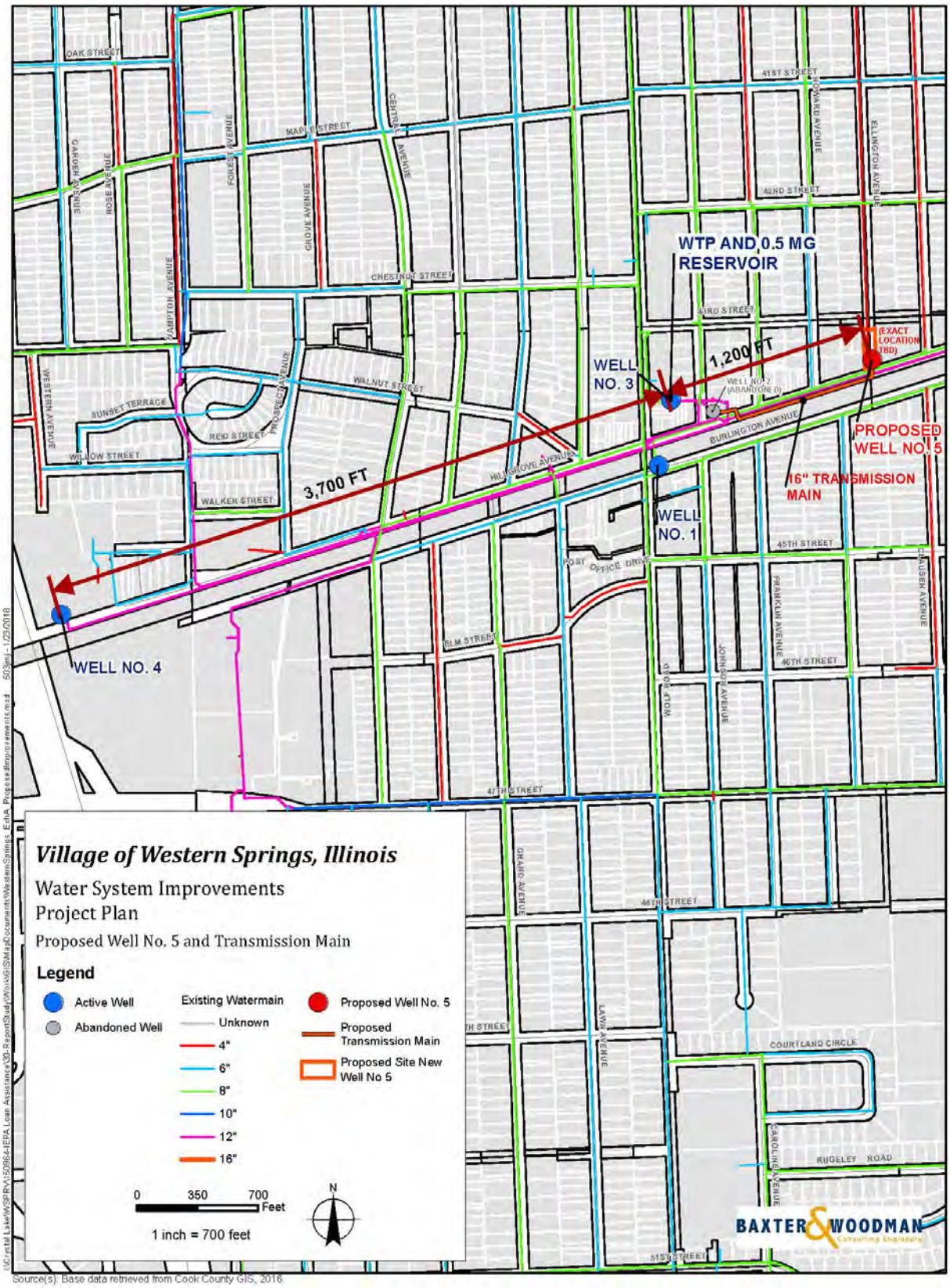


Figure 4- Western Springs Well and Water Main Layout (Baxter & Woodman, 2018)

2.2.2 DISTRIBUTION SYSTEM

In general, the groundwater is pumped from **Well #3** and **Well #4**, treated and/or stored in a reservoir prior to pumping into the Village water tower. As needed, the water is distributed from the water tower to the consumer.

There are nearly 52 miles of water main within the Village (Village of Western Springs website).

2.2.3 TREATMENT

Water from **Well #3** and **Well #4** is pumped from the aquifer to the water plant where the first step is to pass through the AMIAD iron removal system pretreatment filter (manufactured by AMIAD) to remove insoluble iron from the well water. A certain percentage of water from both wells #3 and #4 bypasses the remaining processes and goes straight to the reservoir. The remaining percentage of water proceeds through cartridge vessels that use 70 one-micron membrane cartridge filters to further remove any particulates, prior to the low-pressure reverse osmosis system, which is used as a purification technique. All water is stored in a 500,000-gallon storage holding tank where water is chemically treated before being distributed (Village of Western Springs website).

2.2.4 PLANNED WATER SYSTEM EXPANSION (WELL #5)

The construction of a new deep well has been approved and is scheduled to begin in 2019. This deep well is to circumvent aesthetic and taste issues with **Well #1**, which is a shallow well used in emergency situations. Several sites have been proposed, with one site near Field Park being the best suited and will be the location of the new deep well. The Field Park site is owned by the Western Springs Park District. (Village of Western Springs website). The location of new **Well #5** is almost 1-mile northeast of **Well #4** and not within the Study Area.

2.3 MODIFIED GROUNDWATER PROTECTION NEEDS ASSESSMENT

2.3.1 STUDY AREA

For purposes of assessing any potential impacts from retaining wall construction activities, the area of focus of the GPNA is limited to the west/southwest direction from **Well #4**. The more general study area used to develop the GPNA is a 1,000 feet radius around **Well #4**, as shown in **Figure 1**. This broader study area includes residential, school, commercial, municipal and recreational land uses, along with a portion of I-294 and the BNSF railroad, and the Railroad Bridge Reconstruction Area. The general study area reflects a radius that is equal or greater than what is required for maximum well setback zones (i.e., up to 1,000 feet) and provides for a GPNA review adequate for evaluating the geologic and hydrogeologic frameworks in the vicinity on **Well #4**.

2.3.2 MODIFIED GPNA – SCOPE LIMITATIONS

The following are <u>not</u> within the scope of work of the GPNA:

- Testing of the well for water quality or aquifer properties
- Survey of the well or surrounding hydrologic features
- 3-D and/or numerical modeling of the aquifer.
- Conducting public meetings or providing legal testimony
- Providing 360-degree assessment of water quality risk to the well. Scope of work shall be limited to evaluating environmental risks to the well from the Tollway infrastructure construction and operation.

- Precautions suggested to limit potential physical risks to the well and its operation due to nearby construction activities, including vibration and settlement monitoring
- Schedule adherence subject to response from review agencies

It is important to note that the scope of a GPNA focuses on the risk of contamination to groundwater and quality-related water infrastructure. Potential physical or security risks to the well infrastructure from nearby construction and development activities are beyond the scope of a GPNA. The Village of Western Springs does request monitoring of these risks during construction as appropriate. Recommendations for physical monitoring during construction activities are not within the scope of this GPNA, and precautions suggested to limit physical risks to the well and its operation due to nearby construction activities, including vibration and settlement monitoring will be discussed with The Village outside of this report, and included in the contract plans and specifications as appropriate.

Finally, a typical GPNA process also includes community participation with land use zoning, regulatory and non-regulatory activities. This modified GPNA includes only non-regulatory recommendations that describe actions to protect the water quality and usability of **Well #4** associated with the proposed construction activities.

3.0 METHODS AND PROCEDURES

Based on the scope needed to evaluate the potential for contamination associated with the proposed BNSF railroad bridge reconstruction, a modified GPNA was performed for the Study Area. The modified assessment includes the items shown in **Figure 5**.

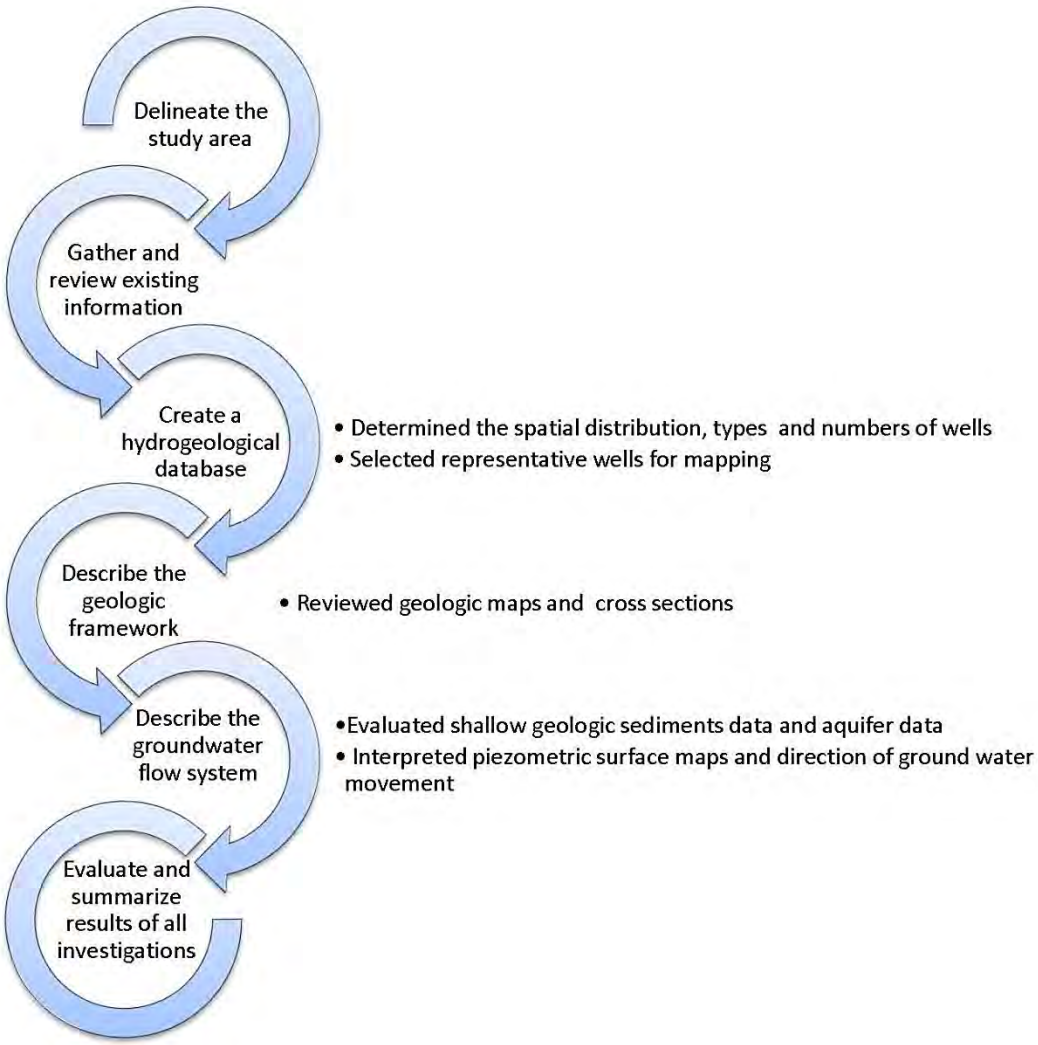


Figure 5- Modified GPNA Flow Diagram

1. Delineation of the Zone of Interest (Study Area), and a larger reconnaissance area.
2. Compile and assess existing Information, including development of a hydrogeologic database of publicly available information relative to regional groundwater characterization and the location and logs of other deep wells in the area.
3. Develop the Geologic Framework, including the analysis and interpretation of State of Illinois Stack maps compiled to prepare geologic maps and cross sections that describe the geology and provide for basic information.
4. Develop aquifer characteristics, including defining the depth, flow direction, hydraulic gradient and velocity of same. This includes identifying regional trends in groundwater flow direction, any divides and areas of groundwater recharge and discharge. This phase shall also include

compiling aquifer testing data that provides information on transmissivities, storativity, and vertical/horizontal anisotropy – if adequate data exists.

5. Delineate groundwater recharge areas, and capture zones.
6. Evaluate results, and summarize the investigation and all data in a report.
7. Prepare responses to questions or comments from Stakeholders, which may include IEPA, Western Springs or others to see that the objective of the GPNA services are fulfilled, namely that an agreeable monitoring and protection plan for **Well #4** is developed so that the Tollway work and retaining wall construction can proceed on schedule with full confidence.

3.1 HYDROGEOLOGIC DATABASE DEVELOPMENT

The database was developed with a combination of publically available data, data provided by the Village, publications, meetings, field investigations, local well drillers and drawings and data obtained from the project team. Primary References are cited in **Section 8.0**.

3.1.1 PUBLICLY AVAILABLE INFORMATION

Local: The Village of Western Springs website contains municipal services information, including the Water Department. General water system and testing data are available, along with posted water treatment and distribution process information. A testing schedule for monitoring water quality parameters for each well is available.

State of Illinois: Hydrogeologic data is also available through publications of the Illinois State Water Survey (ISWS) and the Illinois State Geologic Survey (ISGS). Maps and other information from these sources are referenced throughout the report. **Table 2** compiles a sumary of information obtained regarding local wells, while **Table 3** provides summary hydrogeological information for various hydrostratigraphic units (Visocky, 1985).

3.1.2 WESTERN SPRINGS DATA

The Annual Water Quality Reports / Consumer Confidence Reports (CCR) for water testing performed in 2015-2017 are provided in **Appendix E**. The CCR reports provide updates on maintenance on the water wells, transmission lines and the need for future maintenance, along with water treatment process and water quality test results.

The CCR reports indicate the Illinois EPA has determined that "Western Springs' **Well #3** and **Well #4** source water is not susceptible to contamination…", based on a number of criteria including (**Appendix E**, Western Springs Annual Water Quality Report):

- monitoring conducted at the wells,
- monitoring conducted at the entry point to the distribution system, and
- available hydro-geological data on the well.

In addition to these reports, the Village of Western Springs provided the following:

- Village of Western Springs – Well Nos. 3 and 4 Interference Test (Baxter & Woodman, 2018); **Appendix E**
- Water Study Report (Water Study Group, undated excerpts); **Appendix E**
- Miscellaneous water chemistry data

3.1.3 MEETINGS AND FIELD INVESTIGATION

V3 attended a project kickoff meeting regarding the proposed project to discuss objectives, coordination and scope items. In addition, a field visit was performed to evaluate existing conditions and locate important field features. A photo log is provided in **Appendix D**.

3.2 WESTERN SPRINGS WELL SYSTEM RECONDITIONING

In general, well system reconditioning is done about every 10-15 years. The reconditioning typically involves the well pipe, inspection and reconditioning of the pump well and motor, and inspection of the well shaft. **Well #1** was reconditioned in 2014, **Well #3** in 2015 and **Well #4** in 2010 (Village of Western Springs Website). A 2015 **Well #3** Maintenance Project Completion Report is provided in **Appendix C.**

3.3 GEOLOGIC FRAMEWORK DEVELOPMENT

The regional and local geologic information collected for the study area was obtained from multiple sources (**Section 3.1**). This information was used to develop and present the geologic framework of the study area as a basis for assessing groundwater susceptibility to contamination that might result from the BNSF bridge reconstruction project. Refer to **Section 4.0** for geologic data and mapping, and **Section 5.0** for hydrogeologic data and mapping.

3.4 WELL AND WATER SYSTEM INTEGRITY RISK CHARACTERIZATION

While potential physical or security risks from nearby construction and development are beyond the scope of a GPNA. Some limited commentary is provided based upon our understanding of the construction activities and the proximity to **Well #4** and related water infrastructure such as water mains.

4.0 GEOLOGIC FRAMEWORK

The geology data and mapping is evaluated on a regional scale (**Section 4.1**) to provide context and further evaluated on a local / project scale (**Section 4.2**) to determine the Study Area characteristics.

4.1 REGIONAL GEOLOGIC CHARACTERIZATION

4.1.1 SURFICIAL GEOLOGY

Surficial geology of the region was formed by Pleistocene and Holocene aged glacial processes, where glacial deposits were left during glacial ice advances and retreats. The Village of Western Springs is located in an Illinois physiographic area known as the Wheaton Morainal Country. The surficial geology of this area is generally characterized by the moraines of the Valparaiso Morainic System, a series of low broad ridges roughly parallel to the shore of Lake Michigan, deposited by the Lake Michigan Lobe of the continental ice sheet during the Wisconsin Stage of the Pleistocene Epoch (**Figure 6**).

The moraines are composed predominantly of clayey and silty clay tills of the Wadsworth Formation of the Wedron Group (**Figure 7**). This material is present at or near the surface throughout the northeastern Illinois and may be underlain by one or more, older till sheets. The Wadsworth Formation and the older till deposits are typically separated by thin discontinuous sheets of outwash sand and gravel, and the till sheets may contain isolated lenses of sand and gravel. Following the retreat of glacial ice, the surface of the original till plain was uneven with isolated knolls and depressions. Precipitation has gradually over time, transported material from the higher areas and filled in many of the closed depressions and relatively flat drainage ways with "local wash". The "local wash" materials can range in size from sand to clay and often contain organic material. The total thickness of glacial drift in the area can ranges from less than 25 feet to as much as 200 feet (**Figure 8**).

4.1.1 BEDROCK GEOLOGY

Regional bedrock geology beneath northeastern Illinois and the Study Area generally consists of (from youngest to oldest) Silurian age dolomite and dolomitic limestone followed by Ordovician sandstones and limestone (**Figure 9**). This group overlies Cambrian sandstones and siltstones and pre-Cambrian granitic rock. The stratigraphic sequences are summarized below (**Figure 10**).

The Silurian age dolomites are for the most part covered entirely by glacial deposits. They can be separated into two series; Alexandrian Series, and the Niagaran Series. The Alexandrian Series consists of light grey to grey brown dolomite that is fine-grained, finely sandy, and argillaceous transitioning to a cherty, fine-grained light grey to buff dolomite. The Niagaran Series is a fine to medium-grained silty dolomite with cherty inclusions in the upper portions, and a green to pink trace silty base (Suter et al., 1959).

Underlying the Silurian dolomites, the Maquoketa is a brittle to weak dolomitic shale to fine to coarse-grained argillaceous dolomite and limestone. The unit dips eastward at approximately 10 ft/mi (Suter et al., 1959). The Maquoketa is the upper confining unit for the shallow bedrock aquifers and usually is approximately 150-200 feet thick (Visocky, Ground-Water Hydrology).

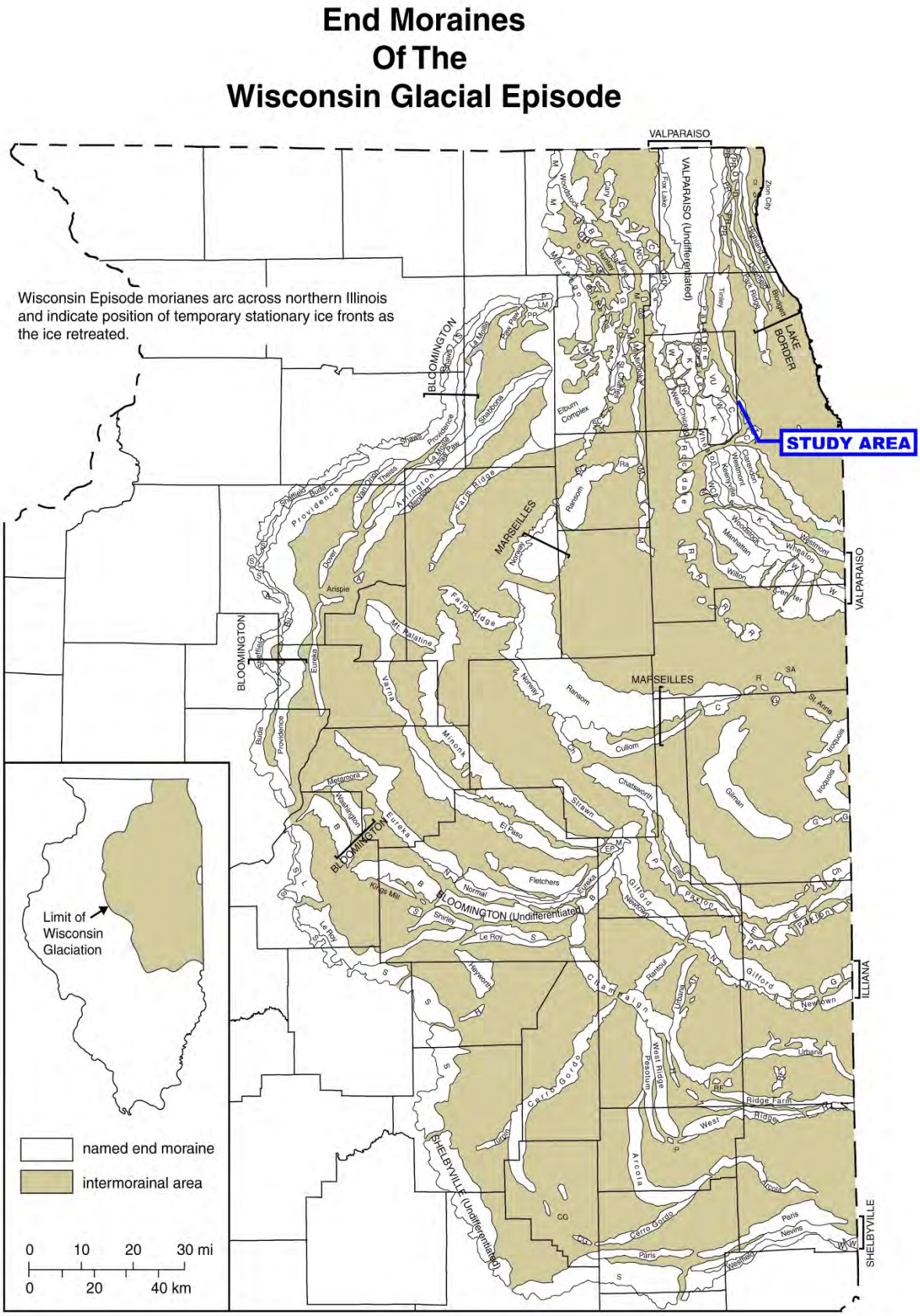


Figure 6- End Moraines of the Wisconsin Glacial Episode

Figure 7- Surficial Geology: Regional (ISGS GIS Database)

Figure 8- Regional Drift Thickness (ISGS GIS Database)

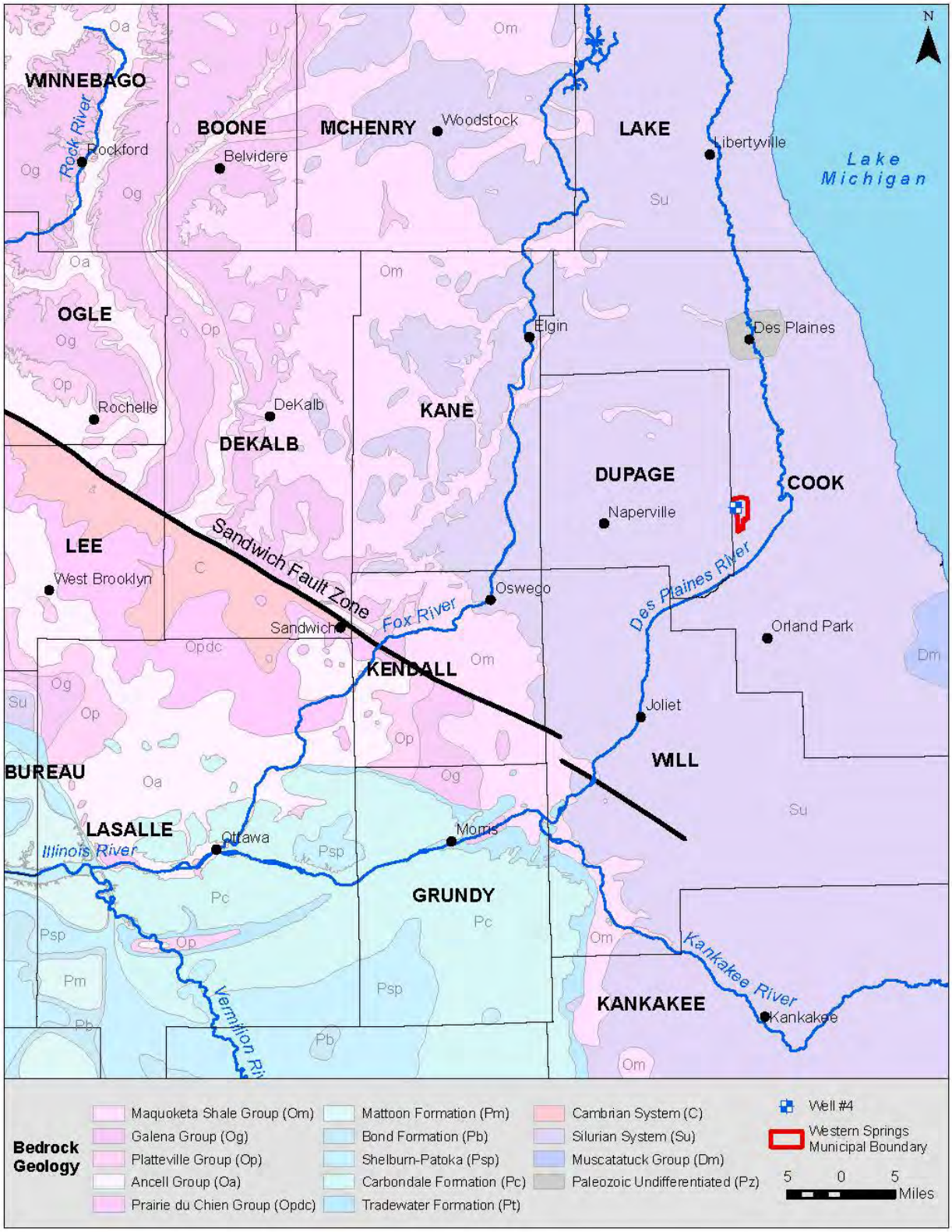


Figure 9- Regional Bedrock Geology (ISGS GIS Website)

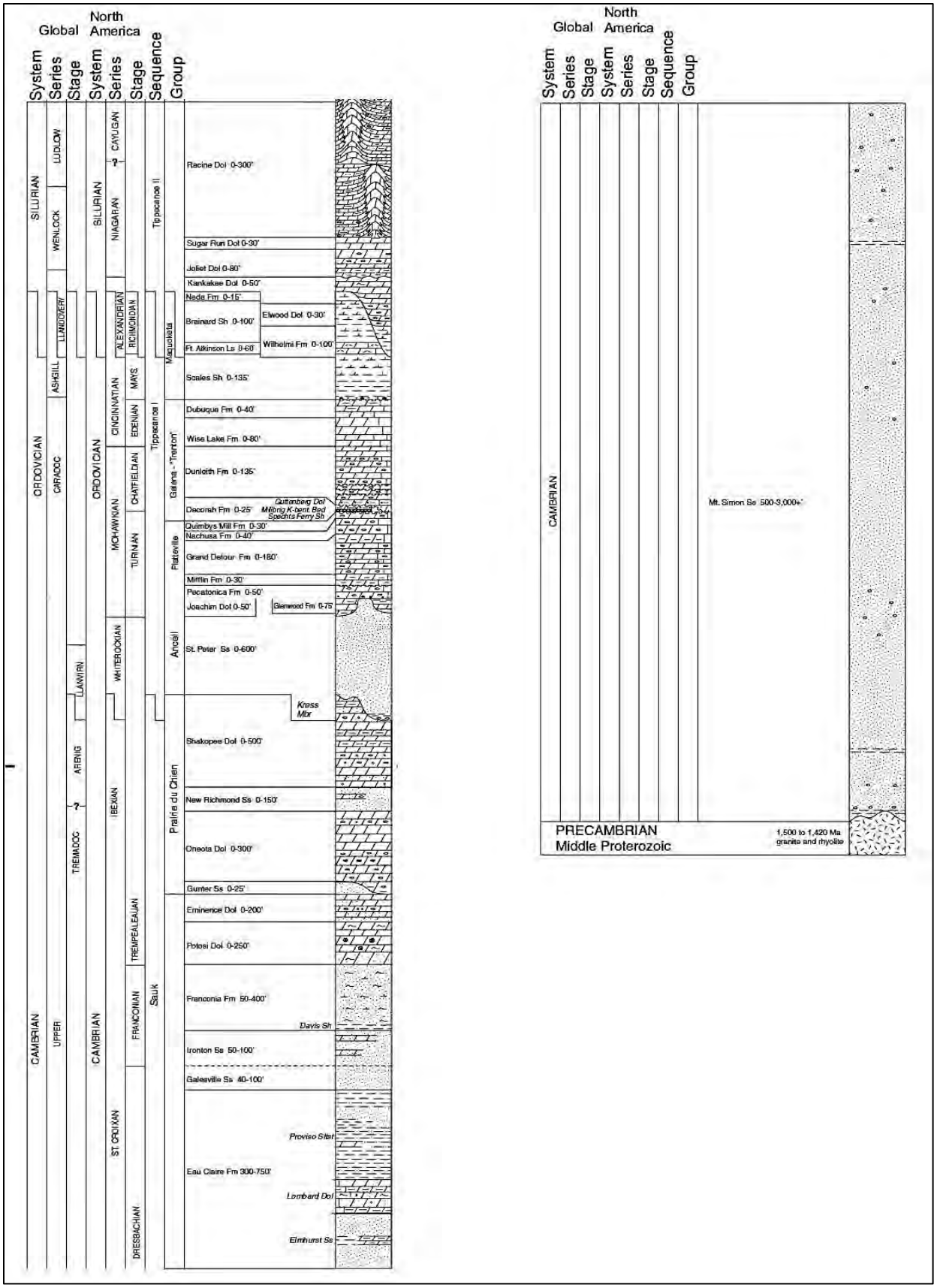


Figure 10- Regional Geologic Stratigraphic Column

The Galena-Platteville is comprised of three formations that are viewed as one when considering hydrology. The formations base is typically sandy, transitioning to very fine to fine-grained argillaceous dolomite with trace chert. The formation transitions to a fine to medium-grained dolomite with laminated grey to red shale. The topmost rock layer is a cherty dolomite that is fine to medium-grain with discontinuous laminated shale (Suter et al., 1959). The general thickness of the unit is 300 to 350 feet and the dip trends eastward at approximately 10 ft/mi (Suter et al., 1959).

The St. Peter Formation is a fine to course-grained sandstone that is lightly dolomitic cemented in parts and contains fluctuating silt content (Suter et al., 1959). The formation is approximately 100 to 200 feet in thickness (**Figure 11**), except in the area of the Sandwich Fault where the thicknesses increase to approximately 400 to 600 feet (Visocky et al., 1985).

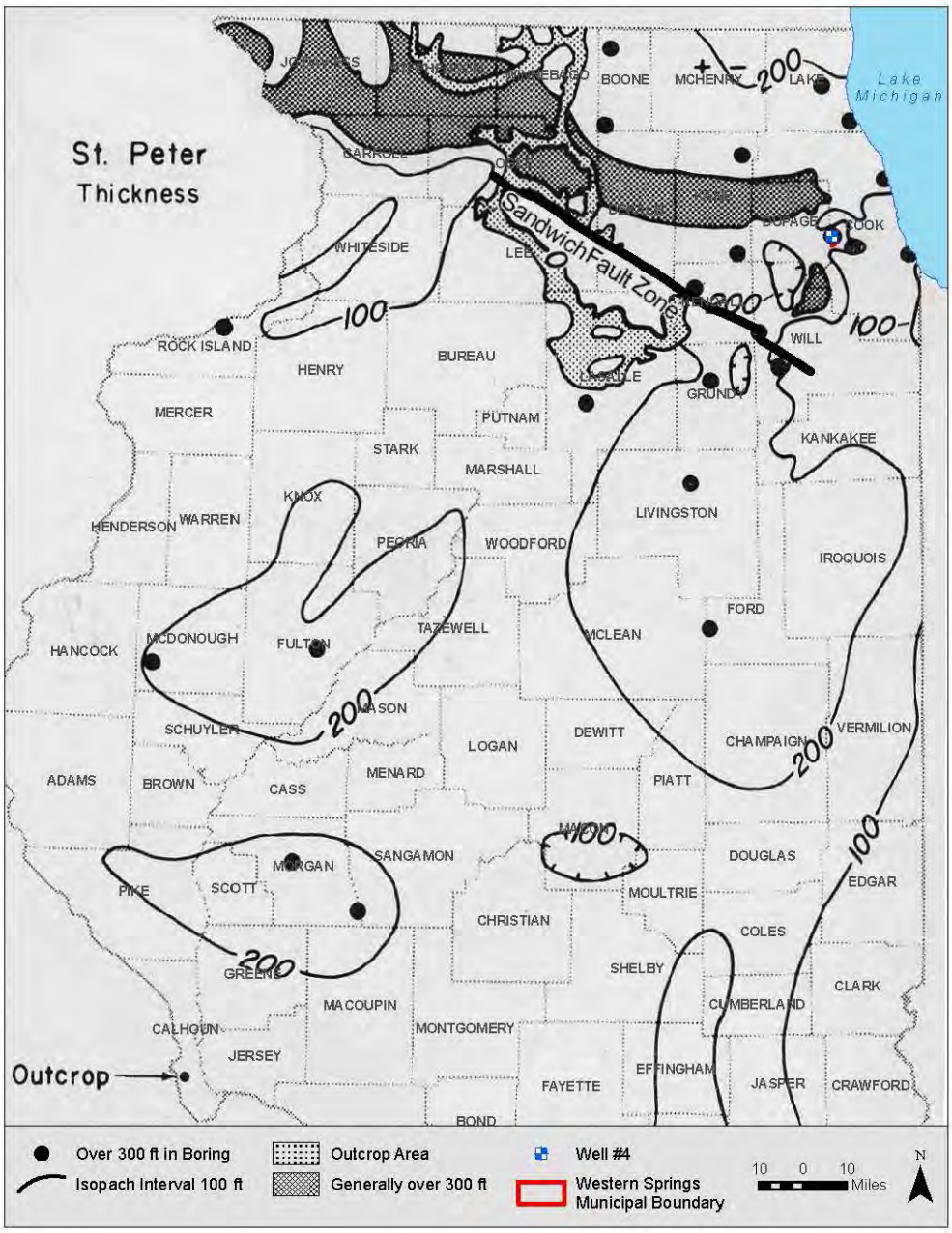


Figure 11- St. Peter Aquifer Isopach (Willman et al, 1975)

The Ironton-Galesville formation is a coarse to fine-grained well-rounded sandstone, dolomitic in part, unlithified to trace friable depending on amounts of dolomitic cementation. The regional dip trends from northwest to southeast at approximately 10 ft/mi (Suter et al., 1959). The formation is in excess of 150 feet thick in the Study Area (**Figure 12**).

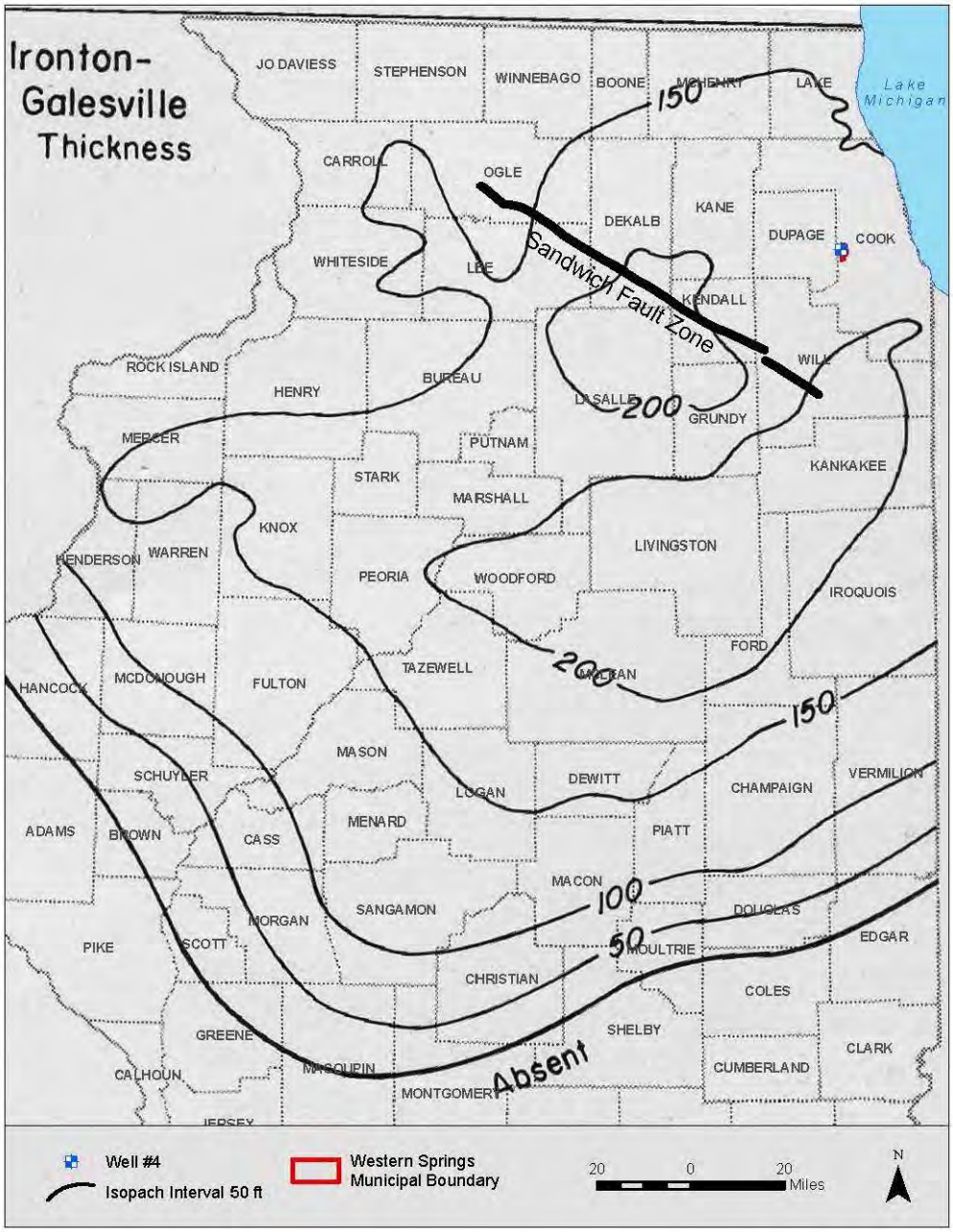


Figure 12- Ironton-Galesville Aquifer Isopach (Willman et al, 1975)

The Eau Claire formation dips trending from northwest to southeast at approximately 11 ft/mi (Suter et al., 1959). The formation consists of dolomite, dolomitic sandstone, shale, and siltstone and is not a major source of groundwater in the upper half of the formation. The lower part of the formation is sandstone that contains pyritized encrusted sand grains (Suter et al., 1959).

The Mt. Simon formation is the deepest aquifer located at approximately 500-1700 feet bgs (Visocky, Ground-Water Hydrology). This formation has a dip trending south to southeast at approximately 15 ft/mi (Visocky, Ground-Water Hydrology). This formation is a fine to coarse-grained sandstone, unlithified to friable, with traces of micaceous shales. The Mt. Simon's thickness in the vicinity of the Study Area is in excess of 2000 feet (**Figure 13**).

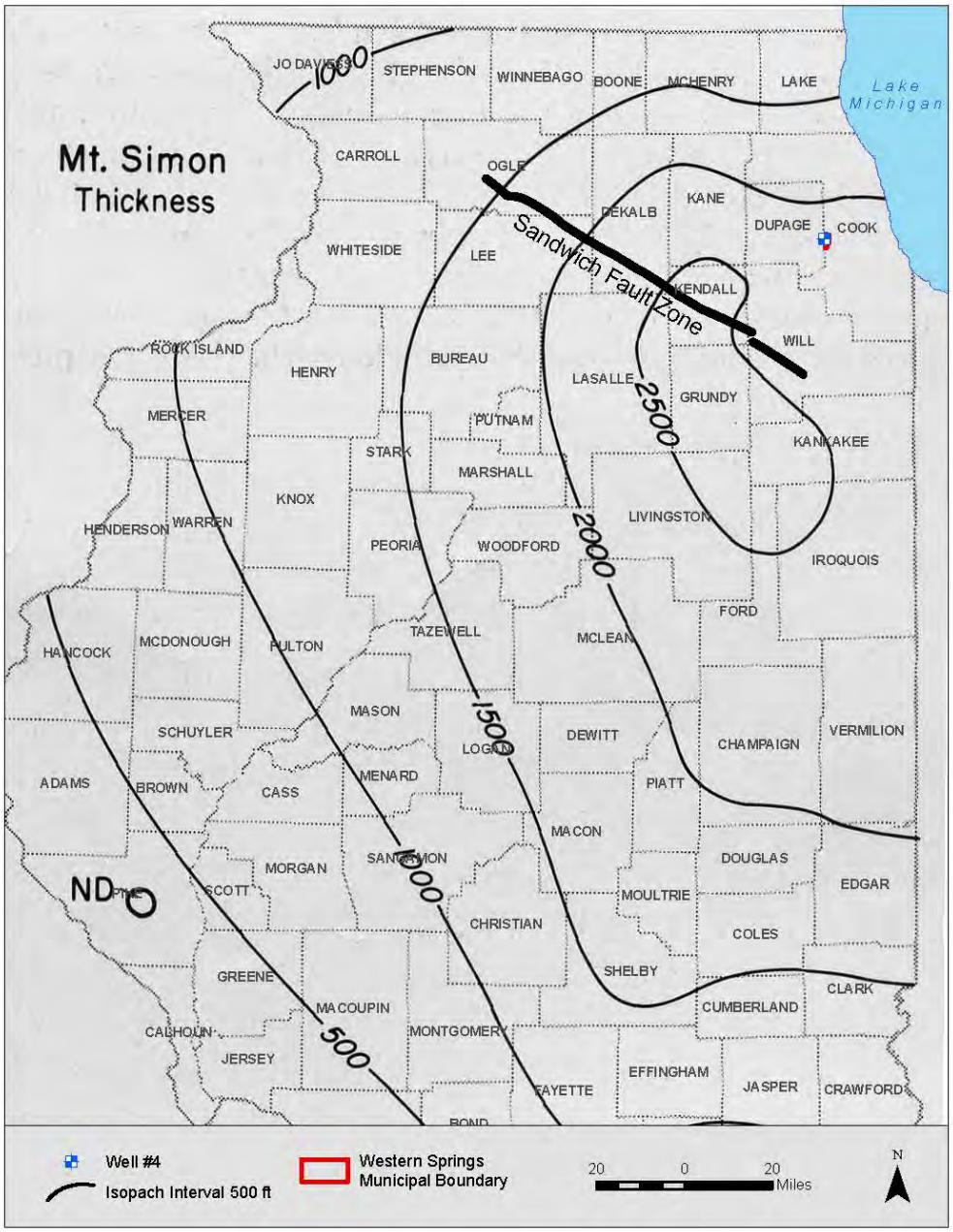


Figure 13- Mt. Simon Aquifer Isopach (Willman et al, 1975)

The Precambrian surface is igneous basement rock. The igneous rock within the Chicago area dips to the southeast at approximately 24 ft/mi. The granitic material is of little to no significant groundwater source, but more an impermeable confining unit (Visocky, Ground-Water Hydrology).

4.2 LOCAL / PROJECT GEOLOGIC CHARACTERIZATION

Several resources were used to assess the local geologic setting of the Study Area. These included local well boring logs (**Appendix B**), including the three Western Springs community wells (**Appendix C**), surficial geology, drift thickness and stack maps, **Figures 14A – 14C**, respectively.

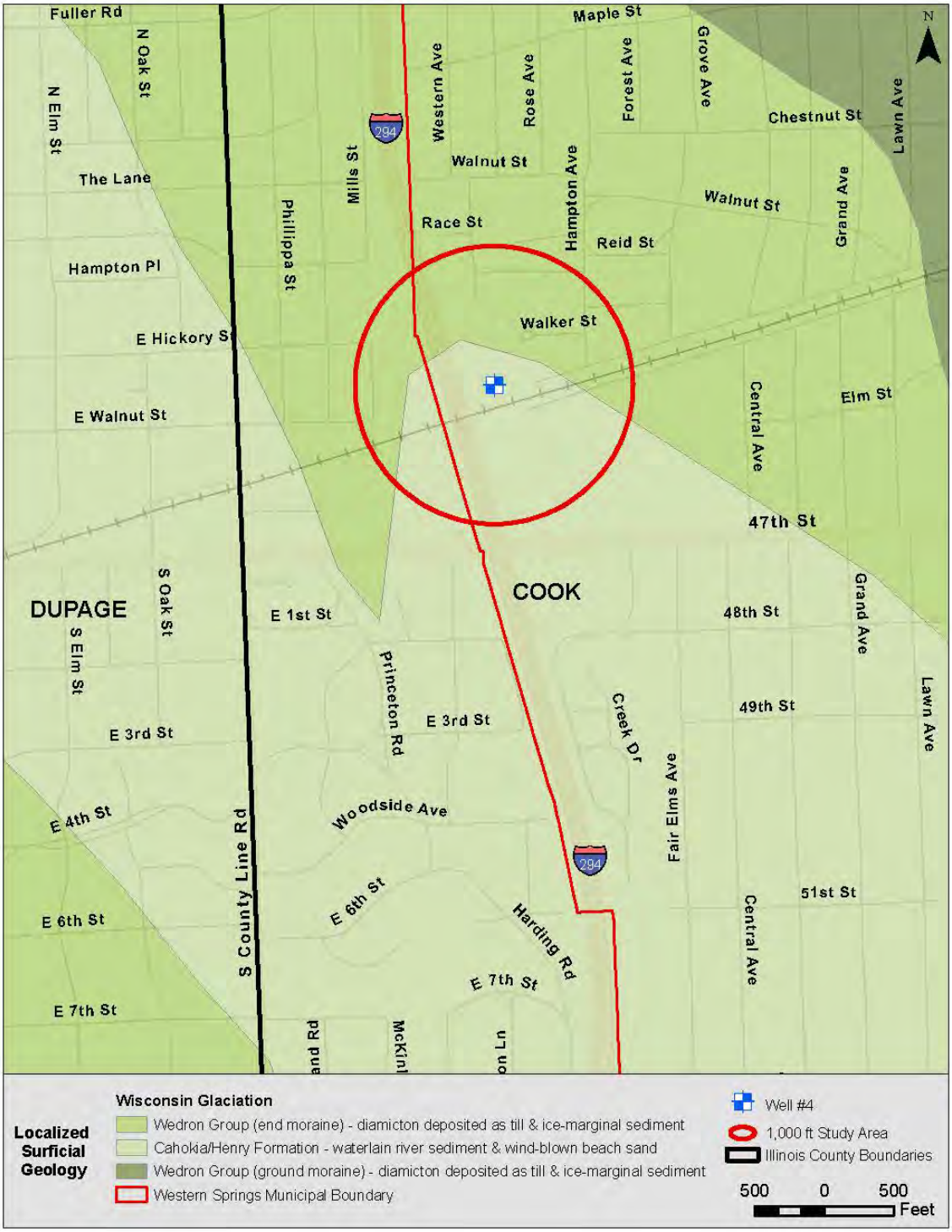


Figure 14A- Surficial Geology: Local (ISGS GIS Database)

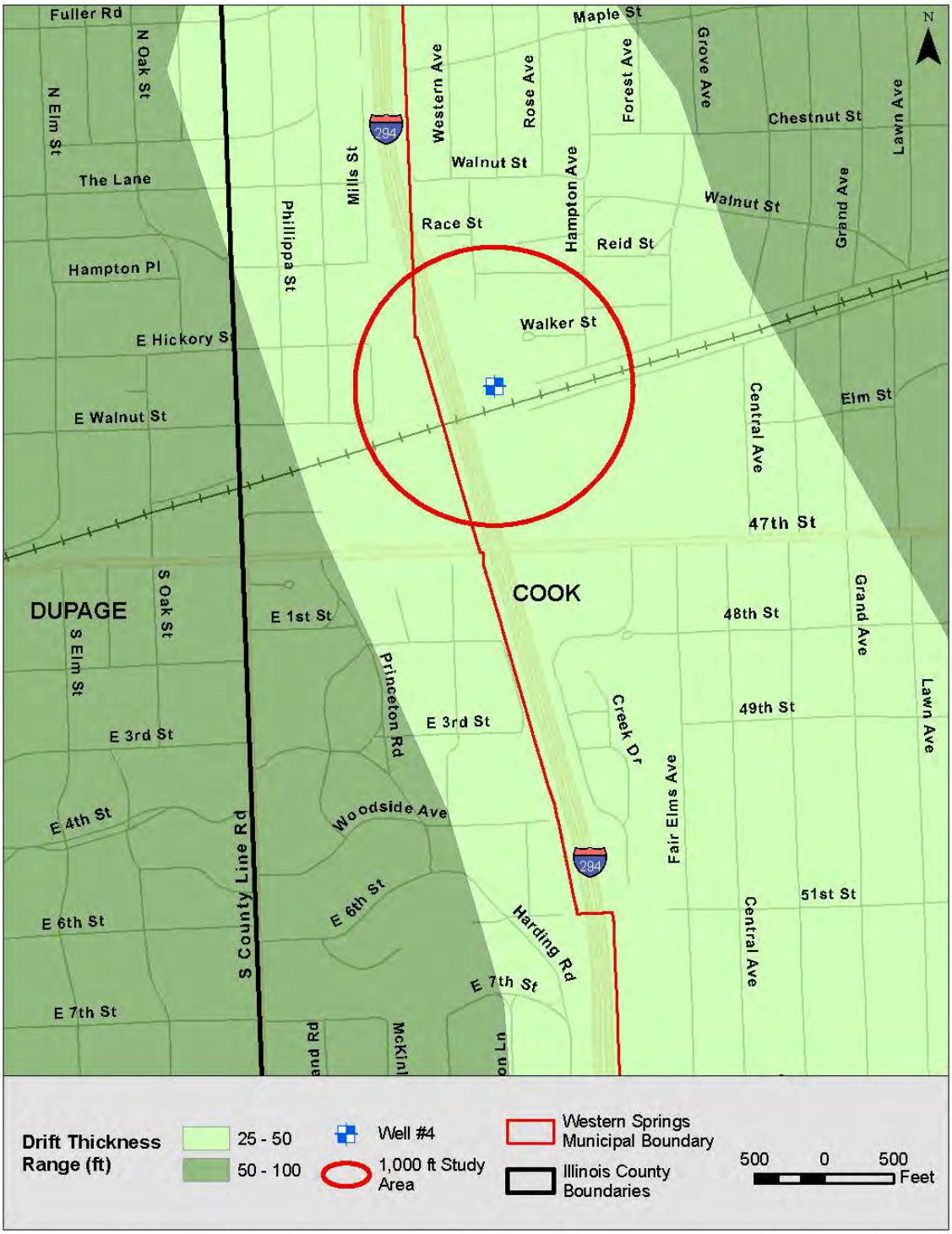


Figure 14B - Local Drift Thickness (ISGS GIS Database)

The study area is located along the western edge of the Tinley end moraine (**Figure 6**). Overlying the uppermost bedrock unit (Silurian dolomite) locally are glacial diamictons (clayey tills) that are 25 to 50 feet thick (**Figures 14A–14B**). The entire sequence of diamictons is attributed to several glacial advances and retreats. The collective unit of glacial drift in this region is referred to as the Wedron Group (Wadsworth Formation). This unit typically consists of gray clayey till deposits with localized sand or silt lenses (Lineback, 1979; Willman, 1971; Willman et. al., 1975).

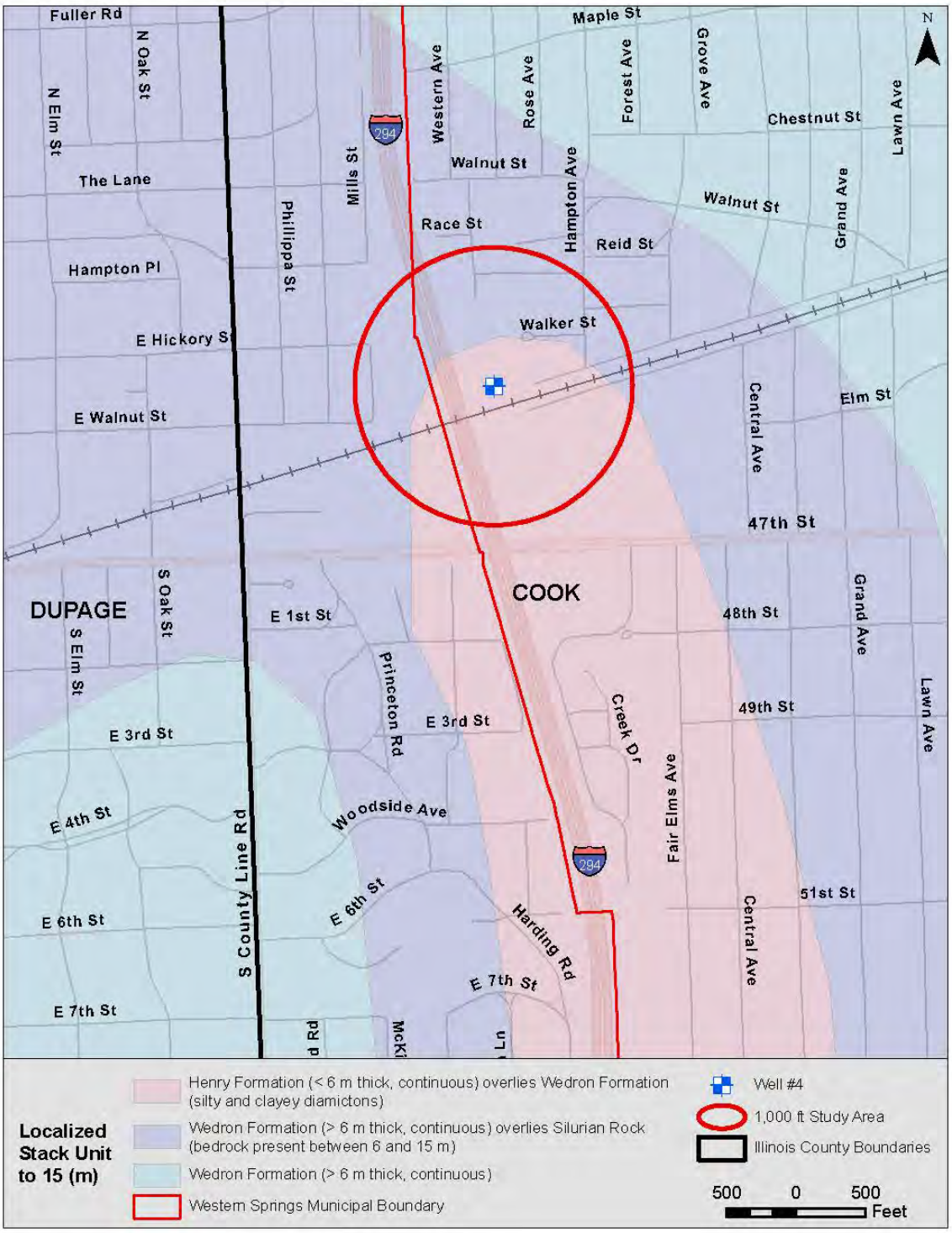


Figure 14C- Stack Map to 50 Feet (ISGS GIS Database)

While **Figure 14A** suggests the Study Area is located within an area of glacial outwash sand and gravel associated with the Henry Formation, a review of the well bore log (**Appendix C**) indicates that the Henry Formation is not present and the Study Area more likely sits upon approximately 25+ feet (**Figure 14B**) of clayey till, while the Henry Formation can be found further to the south. Available stack maps (**Figure 14C**) indicate that the Henry Formation is less than 20 feet thick locally and overlies Wedron Group clays.

According to ISGS Circular 532 (Berg et al., 1984), the location of **Well #4** and the Study Area is designated as being located within a sequence designated as **D2**, while near the boundary to the south of a sequence designated as **A2** (**Figure 15**). The designations are rates as follows relative to their respective shallow aquifer susceptibility to contamination from near surface sources:

- **D2** classification indicates the potential for groundwater contamination is low because of uniform, relatively impermeable silty or clayey till at least 20 ft thick; no evidence of interbedded sand and gravel.
- **A2** classification indicates the potential for groundwater contamination is higher because there is permeable sand and gravel great than 20 ft thick directly below the land surface.

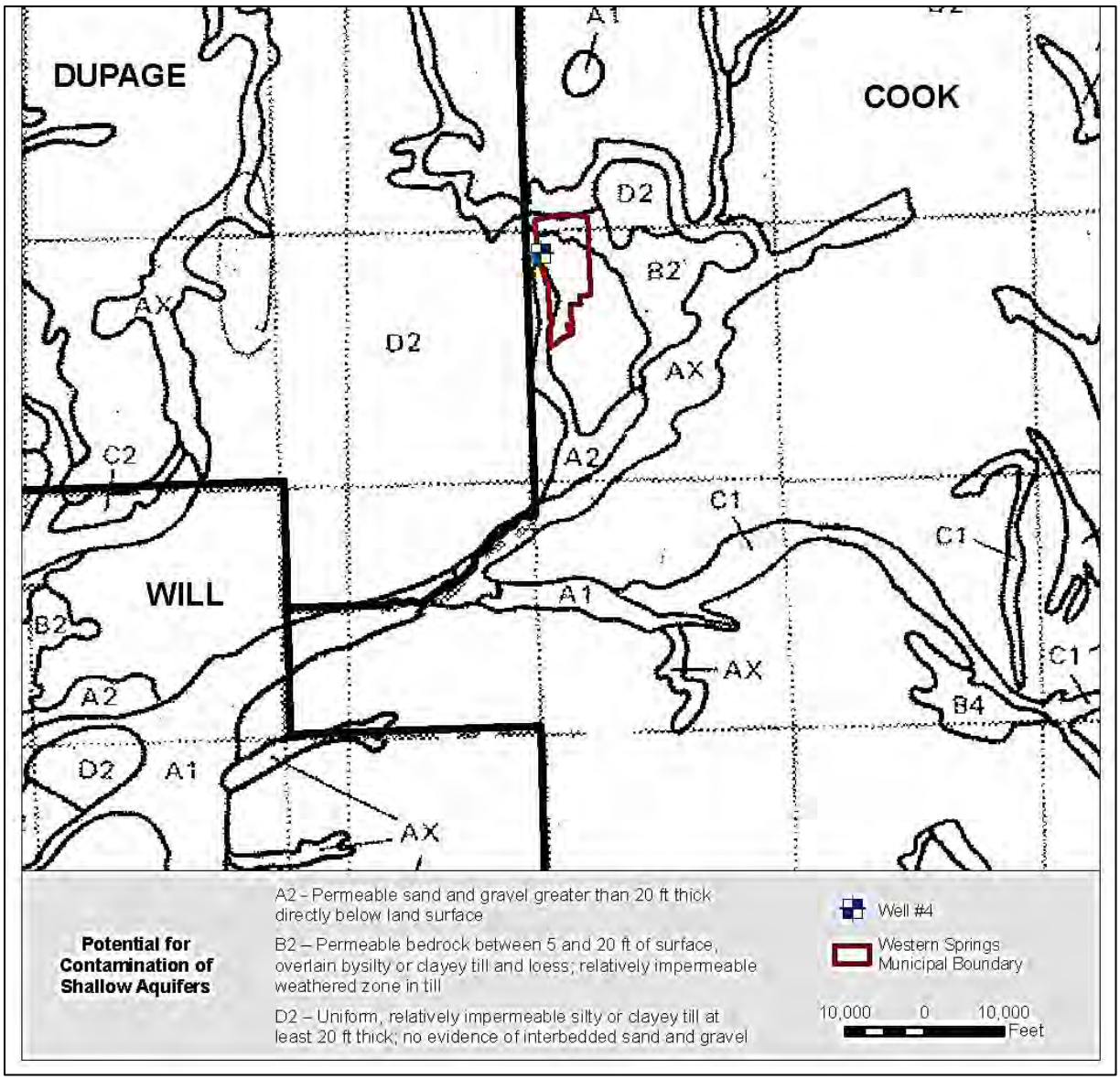


Figure 17- Potential for Contamination of Shallow Aquifers, Plate 2 (Berg, 1984)

5.0 HYDROGEOLOGY

5.1 REGIONAL AQUIFER CONDITIONS

5.1.1 HYDROSTRATIGRAPHIC UNITS

Glacial Deposits: Glacial Deposits can be considered a valuable source for groundwater where substantial thickness of sand and gravel are deposited, particularly at the base of the glacial drift within valleys and along the outer extents of end moraines. Deposits in these areas are often thickest and continuous (Suter et al., 1959). However, within the vicinity of the Study Area, the glacial deposits do not represent a valuable source of groundwater due to the absence of thick basal sand and gravel deposits.

Consequently, the shallow and deeper bedrock units are typically tapped by the neighboring communities that do not obtain their water from Lake Michigan. The following figures and discussions focus on the bedrock hydrostratigraphic units.

Figure 16 provides an east west cross section that effectively illustrates the regional hydrostratigraphic units. The Study Area is generally located within the eastern quarter of the stratigraphic profile.

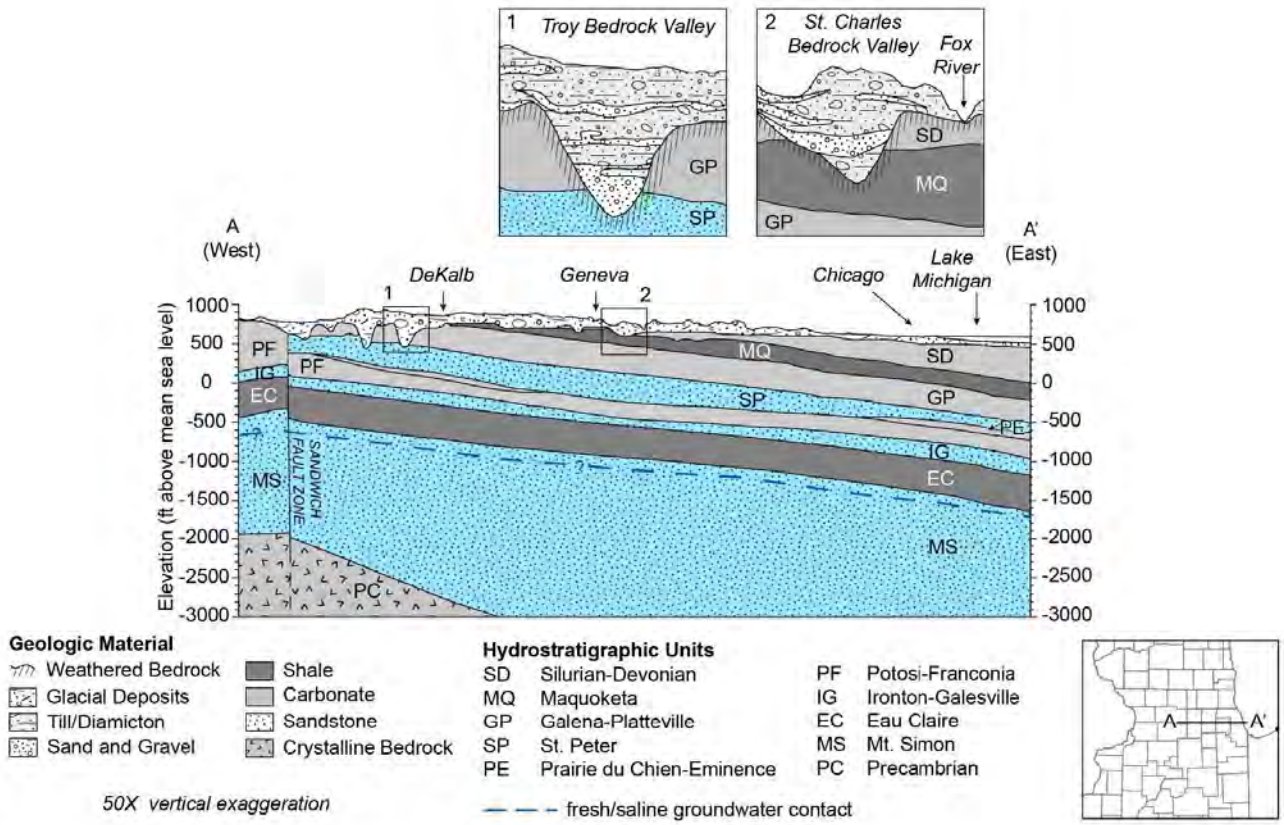


Figure 18- A (West) to A' (East) Cross Section (Sandwich Fault to Lake Michigan) (Abrams, et al. 2015)

To provide additional context, V3 prepared a generalized regional cross section more local to the Study Area that includes Western Springs community **Well #4** and **Well #3** (**Figure 17**).

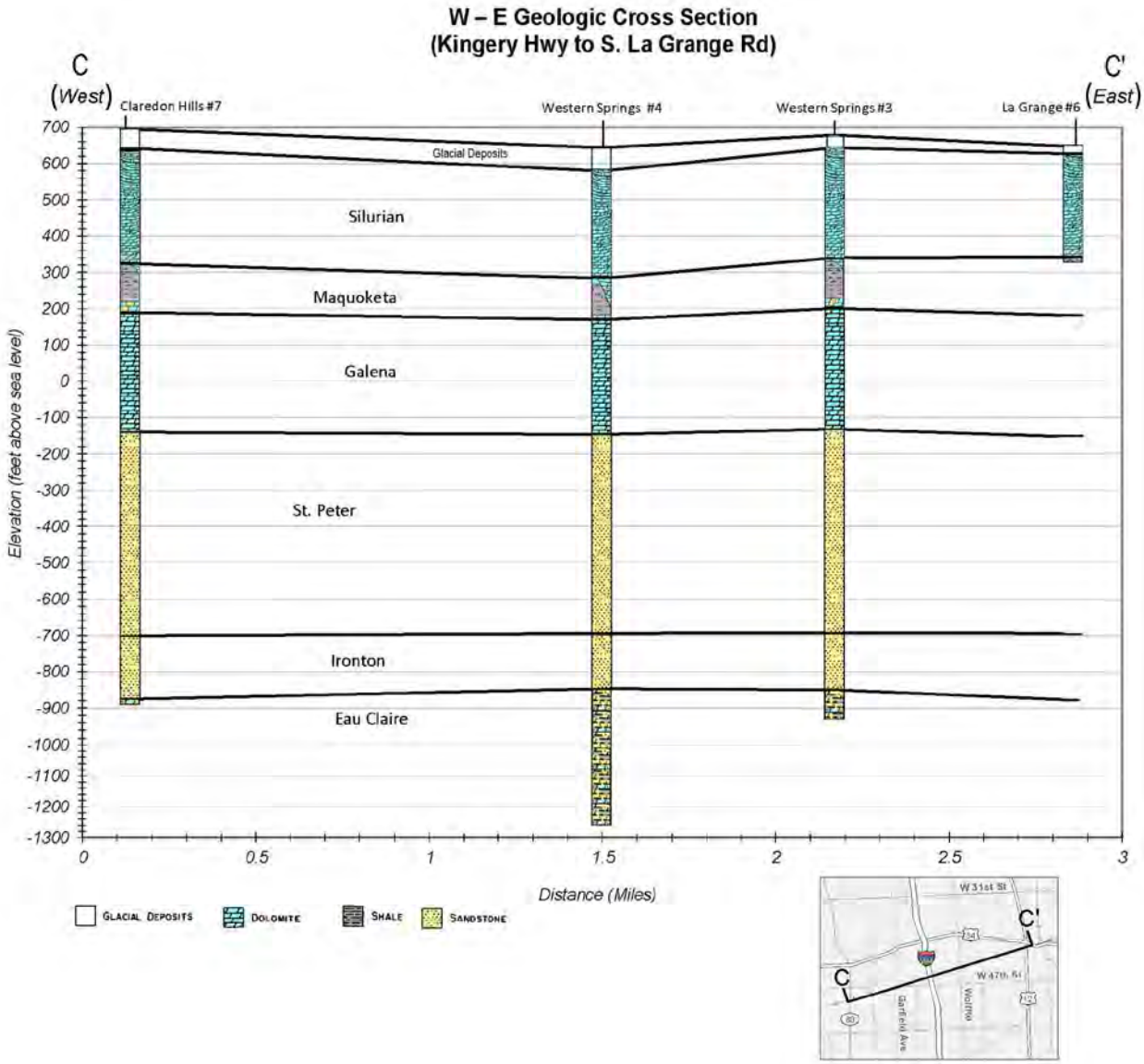


Figure 19- C (West to C' (East) Cross Section (Kingery Hwy to La Grange Rd) (V3 Companies, 2019)

Silurian-Devonian: The yield of the Silurian-Devonian dolomites varies depending on location and solution openings. Where these rocks are overlain by porous glacial sand and gravel deposits, which have a higher degree of infiltration and flow, the dolomite contains more solution crevices, and therefore has direct recharge (Suter et al., 1959). Depending upon local conditions and the well capacities required, some community wells (i.e., LaGrange #6) are completed within and draw water from the Silurian.

Maquoketa: The Maquoketa Formation is mostly impermeable and is a confining unit for the Shallow Bedrock Aquifers. The lower portion is the most impervious where it is a tight shale. The middle portion of the formation is mostly dolomite and can have a small amount of groundwater recovery in joints, and solution dissolution fissures (Suter et al., 1959).

Galena-Platteville: The Galena-Platteville contains fissures, solution cavities and joints that can deliver a small amount of groundwater. The upper portion of the formation is more favorable for water yields due to the more permeable nature of the dolomite (Visocky, Ground-Water Hydrology).

St. Peter: The St. Peter and Glenwood sandstone regionally varies in thickness and geologic properties and therefore can be inconsistent in water-yield. The upper portion of the formation tends to be shaley or dolomitic sandstone with a tighter cementation inhibiting transmissivity. The lower portion is unconsolidated sandstone with shale and conglomerate prone to sluffing (Suter et al., 1959). Despite the variation, this aquifer is considered the second most important aquifer of the Deep Bedrock Aquifer System (Visocky, Ground-Water Hydrology).

Ironton-Galesville: The Ironton-Galesville aquifer is considered the most productive aquifer in the region (Suter et al., 1959). The aquifer formation consists of a thickness ranging between 150 and 200 feet (Visocky, Ground-Water Hydrology).

Eau Claire: The Eau Claire Formation is predominantly impermeable shales, dolomite, and dolomitic limestone in the upper and middle portions of the formation and therefore is considered a confining unit. The formation acts as a barrier to separate the Ironton-Galesville aquifer from saline water intrusion in the Mt. Simon aquifer (Suter et al., 1959). The bottom half of the formation can contribute a low to moderate amount of water where the well is cross-connected with other aquifers (Visocky, Ground-Water Hydrology).

Mt. Simon: The Mt. Simon aquifer is capable of providing moderate amounts of water from the clean sandstone parts of the formation. The aquifer varies highly in water quality, highly mineralized and warmer, and therefore is often less acceptable as a drinking water source as the water is too salty (Suter et al., 1959). At about the depth 1275 feet below sea level, the chloride concentration increases at approximately 400 mg/L per 25 feet of additional well depth (Visocky, Ground-Water Hydrology).

5.1.2 WATER LEVELS WITHIN THE SANDSTONE AQUIFERS

The sandstone aquifers include the Ordovician aged St. Pete, and the Cambrian aged Ironton-Galesville and Mt. Simon. The sandstones tend to be the most important groundwater resource in northeastern Illinois.

Predevelopment potentiometric heads within these aquifers were near or above land surface. Within the Chicago metro region, pumping from the sandstone aquifers has resulted in head declines typically over 300 ft and exceeding 800 ft in the Joliet region as a consequence of heavy demands from the sandstone aquifers in northeastern Illinois, the presence of aquitards limiting recharge to the aquifers, and the presence of the Sandwich Fault Zone that limits water flowing into the aquifers of northeastern Illinois from the south (Abrams, et al, 2015). Drawdowns within the vicinity of the Study Area are on the order of 600 feet (**Figure 18**).

Abrams, et al. (2015) developed hydrographs for northeastern Illinois. The non-pumping heads at Wildwood Subdivision in Lake County, Hanover Park in Cook County, and Villa Park in DuPage County are most applicable to the study area. The non-pumping heads decreased from predevelopment to the mid-1980s, but increased from the mid-1980s to the early 2000s when many communities began to switch to Lake Michigan water, although they are still hundreds of feet below their predevelopment levels (Abrams et al., 2015).

Recent conditions are illustrated in **Figure 18** and **Figure 19**.

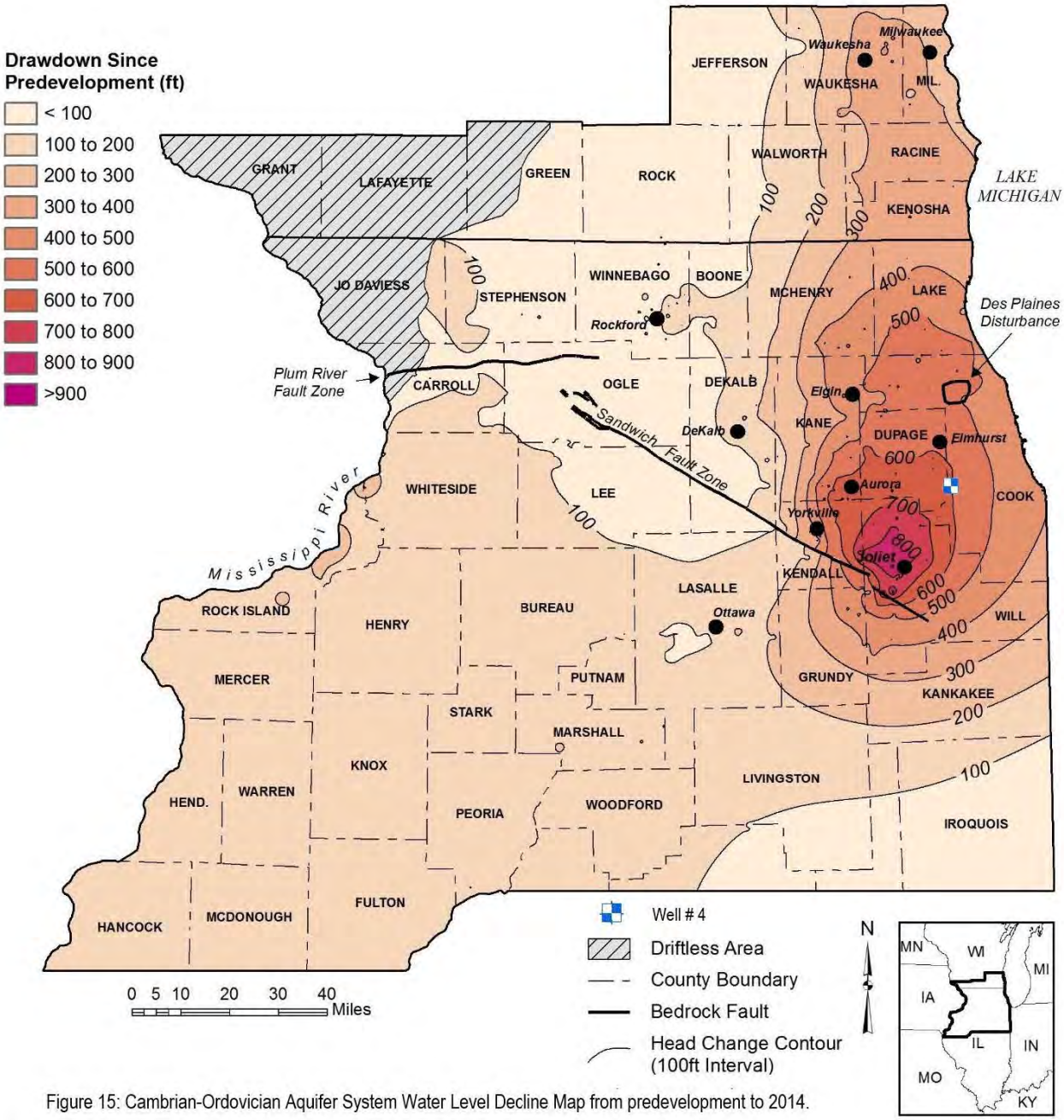


Figure 20- Cambrian-Ordovician Aquifer System Water Level Decline Map (Abrams, et al. 2015)

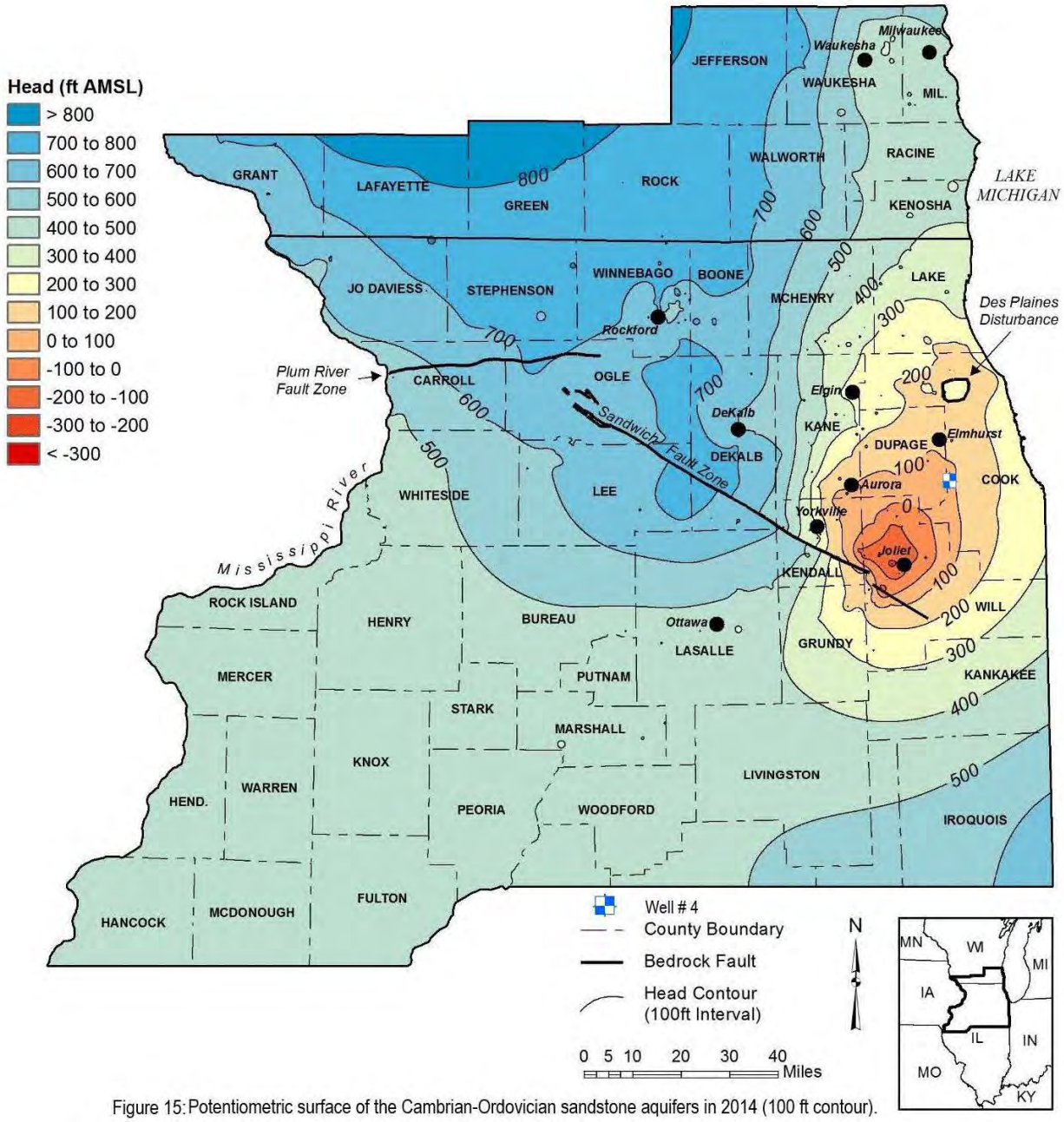


Figure 21- Cambrian-Ordovician Aquifer System Water Level Piezometric Map (Abrams, et al. 2015)

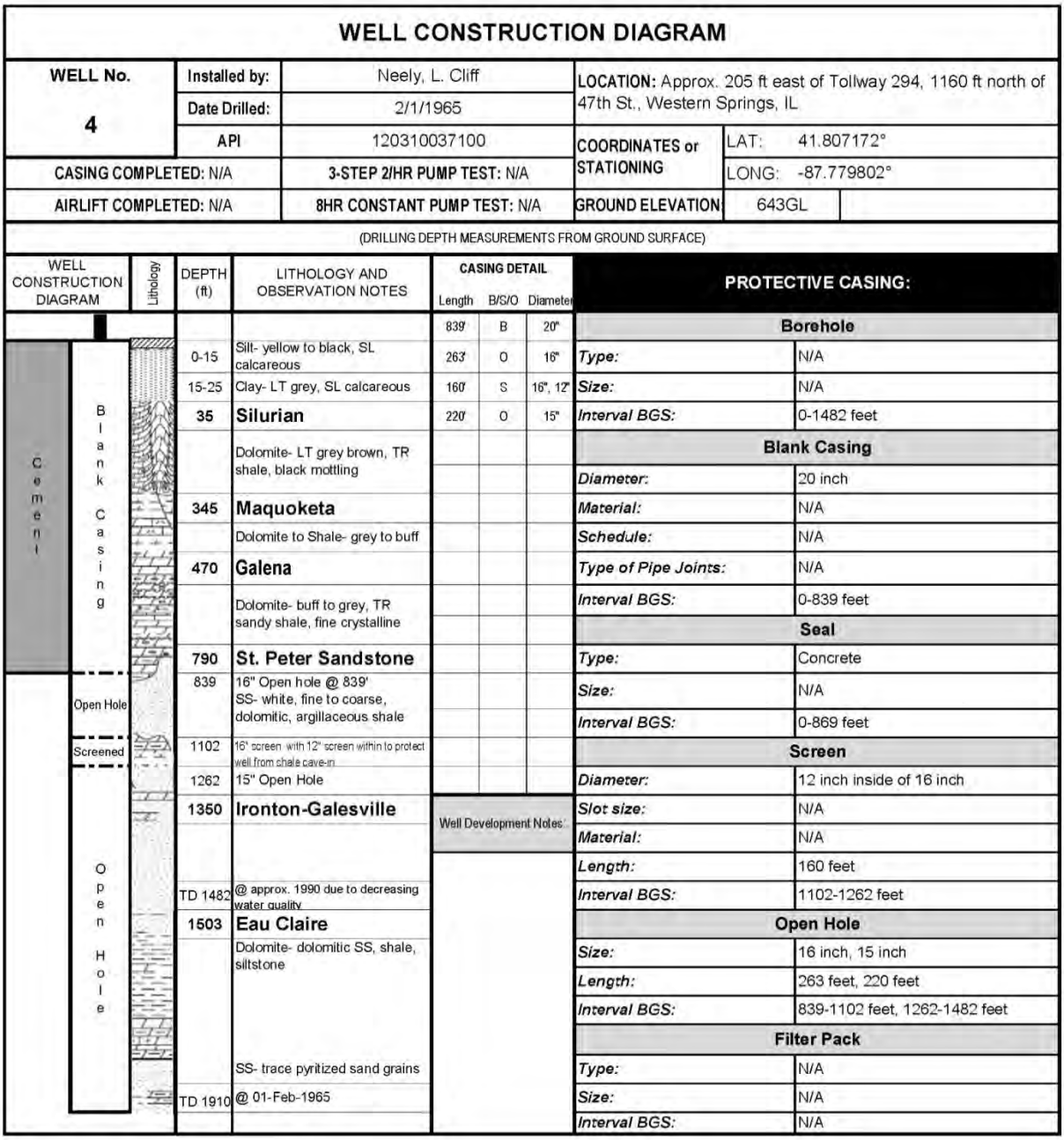
5.2 LOCAL / PROJECT AQUIFER CONDITIONS

Local aquifer conditions were typically reviewed using information obtained regarding local wells (**Table 2)**.

A well construction diagram for **Well #4** was also generated from available information (**Figure 20**). **Well #4** was originally drilled to an approximate depth of 1910 feet. The hole was cased to a depth of approximately 839 feet, and was open to and drawing water from the Ironton-Galesville and Mt. Simon sandstones. In 1991, the botton of the well was filled in to approximately 1482 feet to block off the Mt. Simon, leaving it open only to the Ironton-Galesville (Baxter & Woodman, 2018). Consequently, the primary aquifer of interest for this modified GPNA is the Ironton-Galesville. Regionally, the Ironton-

Galesville receives recharge from surface outcrops or where they immediately underline glacial drift to the west and north. They gain some water from downward leakage through the Maquoketa. Recharge to the Ironton-Galesville is further limited from the southeast by the presence of the Sandwhich Fault.

Figure 20 and the local well bore logs (**Appendix B**) confirm the local presence of both the Maquoketa and Eau Claire shales as confining units and aquitards.



WELL CONSTRUCTION DIAGRAM

WELL No.	Installed by:	Neely, L. Cliff	LOCATION: Approx. 205 ft east of Tollway 294, 1160 ft north of 47th St., Western Springs, IL	
4	Date Drilled:	2/1/1965		
	API	120310037100	COORDINATES or STATIONING	LAT: 41.807172°
CASING COMPLETED: N/A	3-STEP 2/HR PUMP TEST: N/A			LONG: -87.779802°
AIRLIFT COMPLETED: N/A	8HR CONSTANT PUMP TEST: N/A		GROUND ELEVATION	643GL

(DRILLING DEPTH MEASUREMENTS FROM GROUND SURFACE)

WELL CONSTRUCTION DIAGRAM	Lithology	DEPTH (ft)	LITHOLOGY AND OBSERVATION NOTES	CASING DETAIL Length	B/S/O	Diameter
				839'	B	20"
Cement	Blank Casing	0-15	Silt- yellow to black, SL calcareous	263'	O	16"
		15-25	Clay- LT grey, SL calcareous	160'	S	16", 12"
		35	**Silurian**	220'	O	15"
			Dolomite- LT grey brown, TR shale, black mottling			
		345	**Maquoketa**			
			Dolomite to Shale- grey to buff			
		470	**Galena**			
			Dolomite- buff to grey, TR sandy shale, fine crystalline			
		790	**St. Peter Sandstone**			
	Open Hole	839	16" Open hole @ 839' SS- white, fine to coarse, dolomitic, argillaceous shale			
	Screened	1102	16" screen with 12" screen within to protect well from shale cave-in			
		1262	15" Open Hole			
	Open Hole	1350	**Ironton-Galesville**			
		TD 1482	@ approx. 1990 due to decreasing water quality			
		1503	**Eau Claire**			
			Dolomite- dolomitic SS, shale, siltstone			
			SS- trace pyritized sand grains			
		TD 1910	@ 01-Feb-1965			

Well Development Notes:

PROTECTIVE CASING:	
Borehole	
Type:	N/A
Size:	N/A
Interval BGS:	0-1482 feet
Blank Casing	
Diameter:	20 inch
Material:	N/A
Schedule:	N/A
Type of Pipe Joints:	N/A
Interval BGS:	0-839 feet
Seal	
Type:	Concrete
Size:	N/A
Interval BGS:	0-869 feet
Screen	
Diameter:	12 inch inside of 16 inch
Slot size:	N/A
Material:	N/A
Length:	160 feet
Interval BGS:	1102-1262 feet
Open Hole	
Size:	16 inch, 15 inch
Length:	263 feet, 220 feet
Interval BGS:	839-1102 feet, 1262-1482 feet
Filter Pack	
Type:	N/A
Size:	N/A
Interval BGS:	N/A

Figure 22- Well #4 Construction Log (Based on information obtained by V3 Companies, 2019)

The well interference report contained in **Appendix E** (Baxter & Woodman, 2018) indicates **Well #4** has a specific capacity of about 11.75 gpm/ft. of drawdown and a radius of influence (where drawdown goes to 0 feet) of approximately 4000' in radius.

The distance vs. drawdown graph is provided as **Figure 21**. Due to the limited aquifer recharge dynamics of the Ironton-Galesville and its local separation from overlying hydrostratigraphic units by a number of aquitards including the Maquoketa and Eau Claire shales, delineation of a broader capture zone for the well was not performed.

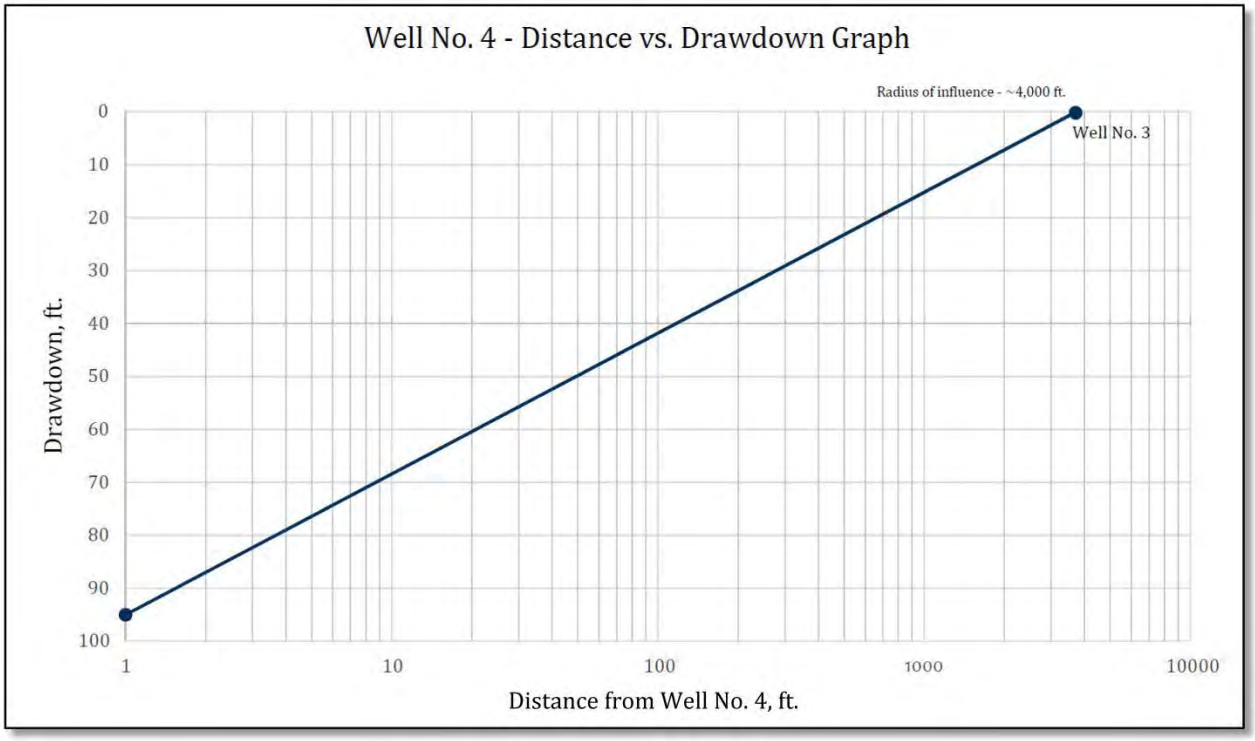


Figure 23- Well #4 Distance vs. Drawdown (Baxter & Woodman, 2018)

5.3 LOCAL AQUIFER SENSITIVITY TO CONTAMINANT SOURCES

The geologic and hydrogeologic review and evaluations summarized in the preceding sections indicate that the primary aquifer of interest for this GPNA is the Ironton-Galesville. The Ironton-Galesville is separated from overlying shallow bedrock units and the unconsolidated glacial deposits by a series of confining units, most notably:

- Wedron Group / Wadsworth Formation – clayey diamicton (glacial till) in excess of 25 feet in the area immediately surrounding **Well #4**;
- Maquoketa Group – mostly impermeable shales in excess of 100 feet thick in the area of **Well #4**;

The lower confining unit separating the Ironton-Galesville from the saline Mt. Simon is the:

- Eau Claire Formation – predominantly impermeable shales, dolomite, and dolomitic limestone in the upper and middle portions of the formation often in excess 300 feet in thickness.

Further, **Well #4** is cemented and cased with 20” diameter blank casing to 839 feet in depth (**Figure 20**), leaving the well drawing water from only the Ironton-Galesville aquifer.

As a consequence of the aforementioned presence of aquitards and well construction, **Well #4** and aquifer of primary interest are not considered vulnerable or typically susceptible to downward migration of contaminants from near surface sources.

6.0 RISKS FROM BNSF BRIDGE CONSTRUCTION

6.1 AQUIFER IMPACT RISK

Aquifer impact risks posed by the BNSF bridge reconstruction project are minimal. The aquifer of interest, the Ironton-Galesville, is a deep bedrock system located greater than 1000 feet in depth, isolated by confining units and is not vulnerable, but minimally susceptible to surface sources of contamination. The depth of construction is typically limited to 15 feet or less below grade, which would occur within an aquitard (Wedron Group clays). Further, the anticipated construction activities do not represent primary or secondary sources of contamination. Consequently, the greatest construction risks include compromising the integrity of the well head and well bore seal/casing and/or physical damage to the related water infrastructure, including the transmission main. These are discussed further in the following sections.

6.2 WATER QUALITY RISKS

Water quality / chemical risks posed by the planned construction activities are expected to be minimal based on the:

- aquifer sensitivity conclusions contained within this GPNA (**Section 5.3**); and
- anticipation that the construction activities and on-going operations do not in and of themselves include a risk of notable contaminant sources.

Some temporary storage of petroleum products and chemicals may occur during construction. The construction contractor will have a site safety plan that provides for an inventory of any petroleum products and chemicals needed during the work. The plan provides for use, storage and spill prevention and containment response actions in the event of a release to the environment.

6.3 WELL & WATER MAIN INTEGRITY RISKS

Physical risks posed by the planned construction activities with the potential to compromise the integrity of nearby water infrastructure such as the well head and transmission water main include:

- Driving / excavating soldier piles for the proposed retaining wall #1, and
- Excavation in close proximity to the 12” water main (**Figure 2**, T05-WSPRG-93).

7.0 RISK MITIGATION & MONITORING

7.1 AQUIFER IMPACT RISK MITIGATION

Temporary storage of petroleum products and chemicals may occur during construction. The location and conduct of these more sensitive activities can be managed through spill plans and best management practices. The construction contractor will have a site safety plan that provides for an inventory of any petroleum products and chemicals needed during the work. The plan provides for use, storage and spill prevention and containment response actions in the event of a release to the environment.

7.2 INFRASTRUCTURE INTEGRITY RISK MITIGATION & SEISMIC MONITORING

The anticipated BNSF bridge reconstruction activities are not unusual or particularly intrusive in their nature or compromising in their proximity to sensitive infrastructure (**Section 6.3**). While beyond the scope of a GPNA, V3 understands the Village of Western Springs expressed concerns with nearby construction activities as a potential, physical risk to the well and its operation. Although these activities do not impact the ground water quality, precautions will be taken, as appropriate, including vibration and settlement monitoring during construction and will be prepared and reviewed with The Village outside of this report.

7.3 SETBACK RECOMMENDATION

The results of this GPNA suggest the existing minimum well setback zone of 200 feet provides adequate protection for Western Springs community **Well #4**. The BNSF bridge reconstruction project includes construction elements that occur within the 200’ setback. However, these activities are of temporary duration and do not represent regulated contamination sources.

8.0 PRIMARY REFERENCES

Abrams, Daniel B., D.R. Hadley, D.H. Mannix, G.S. Roadcap, S.C. Meyer, K.J. Hlinka, K.L. Rennels, K.R. Bradbury, P.M. Chase, J.J. Krause, 2015. *Changing Groundwater Levels in the Sandstone Aquifers of Northern Illinois and Southern Wisconsin: Impacts on Available Water Supply*. Illinois State Water Survey Contract Report 2015-02.

Baxter & Woodman, *Village of Western Springs – Well Nos. 3 and 4 Interference Test,* January 25, 2018.

Bowman, Barrett & Associates, Inc. and ABNA Corp. *Utility and Proposed Station 102+00 to 106+00 cross-section drawings from Proposed BNSF Rail Bridge Reconstruction Drawings*, prepared for The Illinois State Toll Highway Authority, Contract No. I-18-4428, January 2019.

Berg, Richard C, J.P. Kempton, K. Cartwright. 1984. Potential for Contamination of Shallow Aquifers in Illinois. ISGS Circular 532. http://www.isgs.illinois.edu/publications/c532

Illinois State Geological Survey, Illinois Geospatial Data Clearinghouse (GIS website) https://clearinghouse.isgs.illinois.edu/data

- Lineback. 1979. Quaternary Deposits.
- Piskin and Bergstrom. 1975. Glacial Drift Thickness and Character. ISGS Circular 490
- Willman and Frye. 1970. End Moraines of the Wisconsin Glacial Episode Map. Pleistocene Stratigraphy of Illinois, ISGS Bulletin 94.
- Willman et. al. 1967. Bedrock Geology. Geologic Map of Illinois.

Reinertsen, David L., A.K. Hansel, R.D. Norby. 1981. *A Guide to the Geology of the Zion-Lake Bluff Area.* Illinois Institute of Natural Resources State Geological Survey Division Field Trip Guide Leaflet 1981C. https://www.ideals.illinois.edu/bitstream/handle/2142/42808/guidetogeology81rein.pdf?sequence=2

Suter, M., R.E. Bergstrom, H.F. Smith, G.H. Emrich, W.C. Walton, and T.E. Larson. 1959. *Preliminary Report on the Ground-Water Resources of the Chicago Region, Illinois*. Illinois State Water Survey and Illinois State Geological Survey Cooperative Ground-Water Report 1, Urbana, IL.

Village of Western Springs. 2018. https://www.wsprings.com/423/Water-Department

Visocky, Adrian P., Marvin G. Sherrill, and Keros Cartwright, 1985. *Geology, Hydrogeology, and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois*. Illinois State Geological Survey and Illinois State Water Survey Cooperative Groundwater Report 10.

Visocky, Adrian P, *Water Level Trends and Pumpage in the Deep Bedrock Aquifers in the Chicago Region.* Illinois State Water Survey, 1997.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon. 1975. Handbook of Illinois Stratigraphy. Illinois State Geological Survey Bulletin 95, Urbana, IL.

Willman, H. B., 1971. Summary of the geology of the Chicago area. Illinois State Geological Survey Circular 460.

Zucchero, Rocco. March 26, 2018. *Western Springs Board Meeting Presentation*.

TABLES

Table 2 - Water Well Summary Table
Western Springs , Illinois

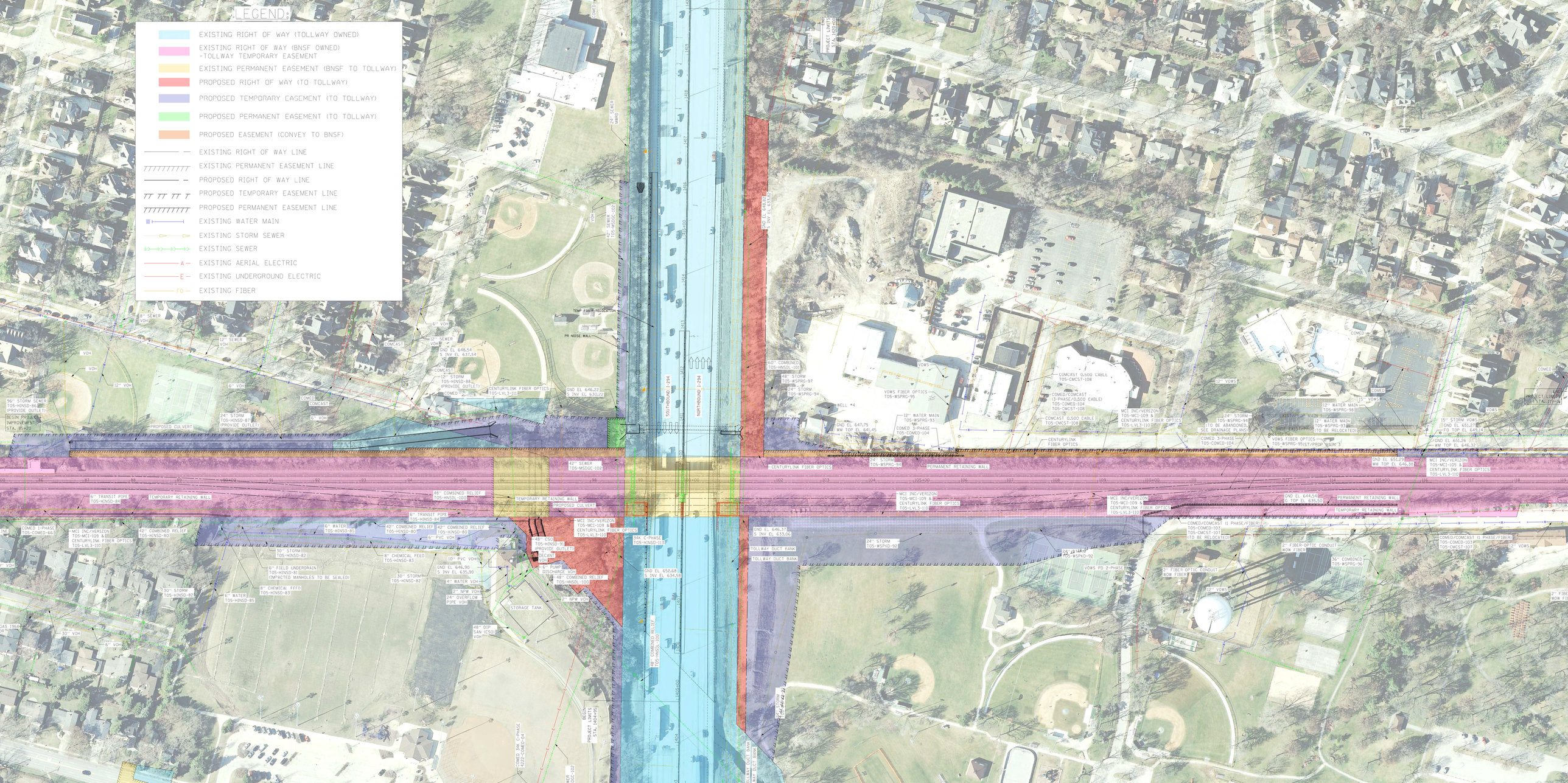
Western Springs Wells:	API Number	ISWS Pnumber	Status	Latitude	Longitude	Location	Driller	Date Drilled	Elev (ft)	Elev Ref	TD (ft)	Formation	Top	Casing (ft)	Rate (gpm)	Pump Depth (ft)
Chicago Highlands G.C. #2	120313600700	---	Irrigation	41.83925	-87.9135	30-39N-12E Cook	Kerry, Todd	3/2/2010	---	---	1178	---	---	---	600	900
Electro-Motive Corp #2	120310242900	---	Active	41.796161	-87.858602	10-38N-12E Cook	Miller, J. P. Art. Well	1/1/1937	647	GL	460	---	---	---	---	---
Electro-Motive Corp #3	120310243000	---	Active	41.796106	-87.8586	10-38N-12E Cook	---	1/1/1937	647	GL	600	---	---	---	---	---
La Grange City Well #1	120310159300	---	Active	41.810806	-87.878824	06-38N-12E Cook	Pub Serv. Co. of IL	---	645	GL	1962	Maquoketa Galena St. Peter	350 480 808	---	---	---
La Grange City Well #3	120310240200	---	Active	41.811237	-87.878117	04 -38 -12E Cook	Pub Serv. Co. of IL	1/1/1908	645	TM	930	---	---	---	---	---
La Grange City Well #4	120310160800	---	Active	41.812454	-87.863976	04 -38 -12E Cook	Cater William	1/1/1928	629	GL	725	---	---	---	---	---
La Grange City Well #6	120310159200	--	Active	41.812266	-87.885418	05-38N-12E Cook	Miller, J. P. Artesian Well Co.	10/1/1949	652	GL	352	Silurian Maquoketa	25 352			
La Grange Village #8	120312595000	---	Active	41.810604	-87.878593	04 -38 -12E Cook	Wehling Well Works Inc	6/1/1978	646	TM	1538	Maquoketa Galena St Peter Eau Claire	323 483 863 1533	---	---	---
MSD Chicago-Mainstream Sys #DH71-97 (Q3)	120313418300	---	Active	41.801948	-87.861195	09-38N -12E Cook	Harza Engineering Co.	10/4/1971	633	GL	846	---	---	---	---	---
Nazareth Acad HS #0	120310240800	---	Active	41.818486	-87.880892	05-38N-12E Cook	Miller, J. P. Artesian Well Co.	---	644	TM	1902	Silurian Maquoketa Galena St Peter Ironton Eau Claire	20 342 465 800 1340 1525	---	---	---
Our Lady of Beth Aca #0	120310280800	---	Active	41.821015	-87.889341	32-39N-12E Cook	Miller, J. P. Art. Well	---	643	DM	1902	---	---	---	---	---
Western Springs #1	120310240900	---	Emergency Supply	41.809681	-87.898334	5 - 38N - 12E Cook	Geiger, S. B. Co.	1/1/1923	671	GL	385	Silurian Maquoketa	40 385	---	---	---
Western Springs #3	120310002400	410628	Active	41.810512	-87.898016	05-38N-12E Cook	Miller, J. P. Art. Well	1/1/1955	678	GL	1600	Silurian St. Peter Ironton Eau Claire	35 810 1370 1528	---	1130	910
Western Springs #4	120310037100	410631	Active	41.807172	-87.911145	6-38N-12E Cook	Neely, L. Cliff	2/1/1965	643	GL	1910	Silurian Maquoketa Galena St Peter Ironton Eau Claire	64 360 474 790 1337 1490	1-1222	1110	769
Hinsdale Wells:																
Clarendon Hills #7	120430320900	---	Plugged	41.800288	-87.938508	11-38N-11E DuPage	Layne Western Co., Inc.	2/7/1973	694	TM	1585	Galena St Peter Knox Ironton Eau Claire	504 835 1025 1395 1570	---	---	---
McIntosh A.T.	120430168000	---	Active	41.795572	-87.958862	11-38N-11E DuPage	Gray Well Drilling	1/1/1923	725	GL	970	---	---	---	---	---
Suburban Hospital #3	120433084700	---	For Business	41.792102	-87.918326	12-38N-11E DuPage	---	1/1/1958	---	---	1540	---	---	1-983	12	420
Surburban Cook Co Tb #3	120310015600	---	Active	41.786645	-87.91656	18-38N-12E Cook	Wehling Well Works Inc.	6/1/1958	689	GL	395	---	---	---	---	---
Young, Robert; Serwat, Leonard D.	120432909600	---	Private	41.785763	-87.959169	15-38N-11E DuPage	Knierim, Phil	9/26/1991	---	---	---	---	---	---	---	---

Unit Name	Lithology	Aquisystems and Aquigroups	Thickness Range [ft]	Hydrologic Properties	Average transmissivity [gpd/ft]	Average Storage Coefficient	Leakage Coefficient [gpd/ft^3]	Specific Capacity [gpm/ft]	Groundwater Quality (confined aquifers) [mg/L]
Quaternary System	Glacial material- sand and gravel loess alluvium, windblown sand, silt	Prairie Aquigroup		Shallow aquifer Unconfined	Widely Varies	Widely Varies	---	0.1-5600	TDS 400-600 Hardness 300-400 Iron 1-5
Siurian System	Dolomite	Upper Bedrock Aquigroup	~100	Aquifer	10,500 to 85,400	$9.0x10^{-5}$ to $3.5x10^{-4}$	---	= or < 80	TDS 400-1000 Hardness 200-400 Iron 0.3-1.0
Maquoketa Group	Shales- calcitic, dolomitic, argillaceous limestone	Midwest Bedrock Confining Unit	85-227	Confining unit	---	---	2.5×10^{-7}		---
Galena Group	Limestone and dolomite	Midwest Bedrock Aquigroup		Minor aquifer		3.9 × 10-4	---		TDS 400-1400 Hardness 175-600 Iron >1.0
Platteville Group	Limestone- lolomite-mottled, cherty dolomite								
Glenwood Formation (Upper Ancell Group)	Sandstone- dolomitic, medium to coarse well rounded quartz in fine sand, coarse silt matrix		200-450	Aquifer	10,000 and 20,000				
St. Peter (Lower Ancell Group)	Sandstone- very fine to coarse-grained very well sorted quartz sand			Aquifer					
Knox Megagroup	Dolomitic with sandstone stringers			Confining unit	----				
Ironton and Galesville	Sandstone		175-200	Aquifer	10,000 and 20,000				
Lombard and Proviso Members of Eau Claire Formation	Dolomite and dolomitic sandstone, siltstone, shale	Basal Bedrock Confining Unit		Confining unit	---	---	~ 2.5×10^{-7}	---	---
Elmhurst-Mt. Simon	Sandstone- fine to coarse-grained sand, interbedded shales	Basal Bedrock Aquigroup	~2000	Aquifer	980 to 10,600	$5.2x10^{-4}$ to $1.8x10^{-4}$	7.5×10^{-8} to 1.5×10^{-7}	0.3 to 0.4	TDS 235-4000 Hardness 220-800 Iron 0.1-20
Precambrian	Granite	Basal Bedrock Confining Unit		Confining unit	---	---	---	---	---

Visocky, Adrian P., Marvin G. Sherrill, and Keros Cartwright, 1985. *Geology, Hydrogeology, and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois* . Illinois State Geological Survey and Illinois State Water Survey Cooperative Groundwater Report 10.

APPENDIX A

BNSF PROPOSED CROSS SECTIONS - RAILROAD
(STATIONS 102+00 TO 106+00)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EXISTING RIGHT OF WAY (BNSF OWNED -TOLLWAY TEMPORARY EASEMENT
EXISTING PERMANENT EASEMENT (BNSF TO TOLLWAY)
PROPOSED RIGHT OF WAY (TO TOLLWAY)
PROPOSED TEMPORARY EASEMENT (TO TOLLWAY)
PROPOSED PERMANENT EASEMENT (TO TOLLWAY)
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EXISTING UNDERGROUND ELECTRIC
EXISTING FIBER
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NORTHBOUND I-294
TEMP FIBER RELOCATION
PR NOISE WALL
PROPOSED CULVERT
TEMPORARY RETAINING WALL
PERMANENT RETAINING WALL
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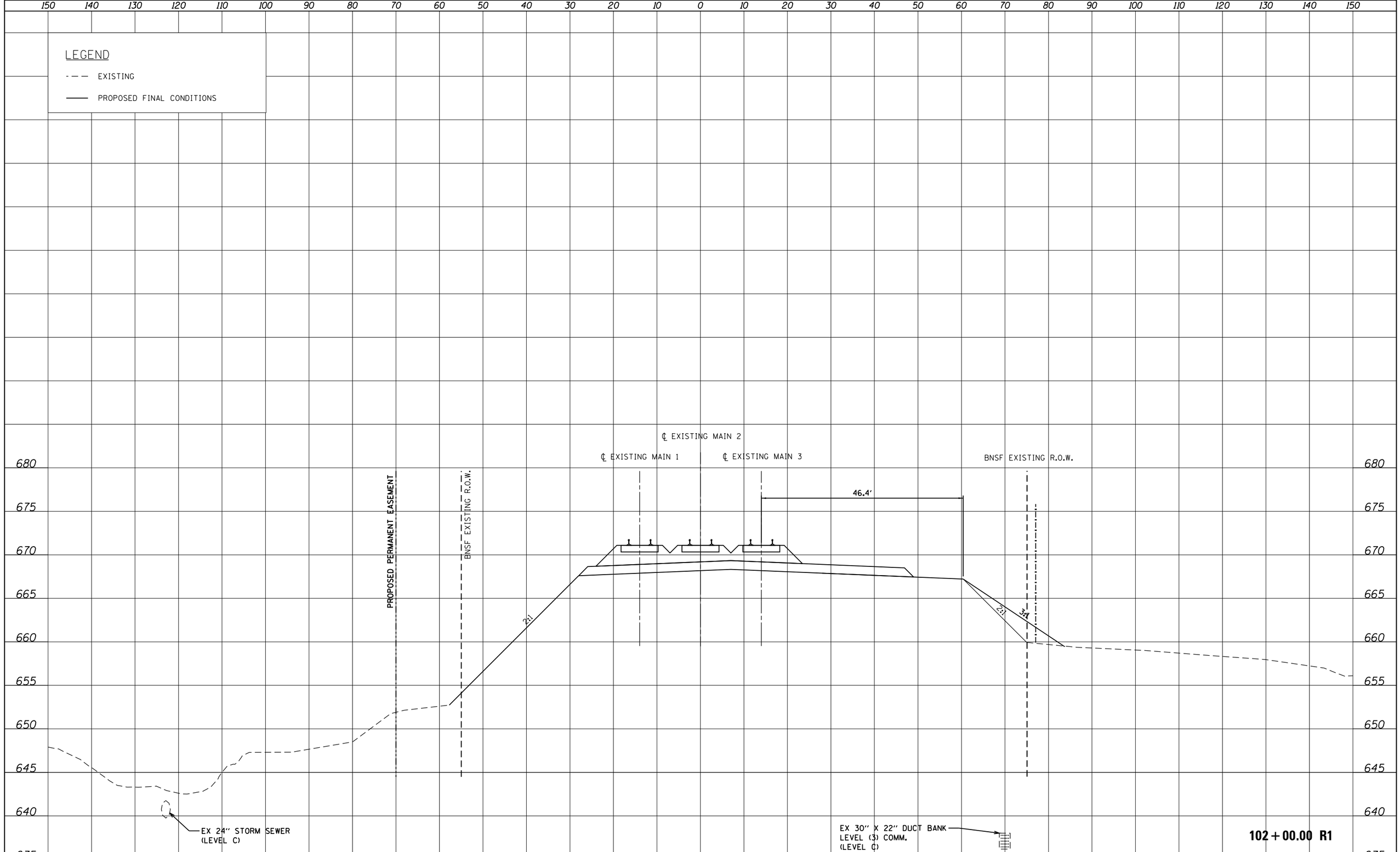

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CHECKED BY JK	DATE $DATE		

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

PROPOSED CROSS SECTIONS - RAILROAD
STA. 102+00

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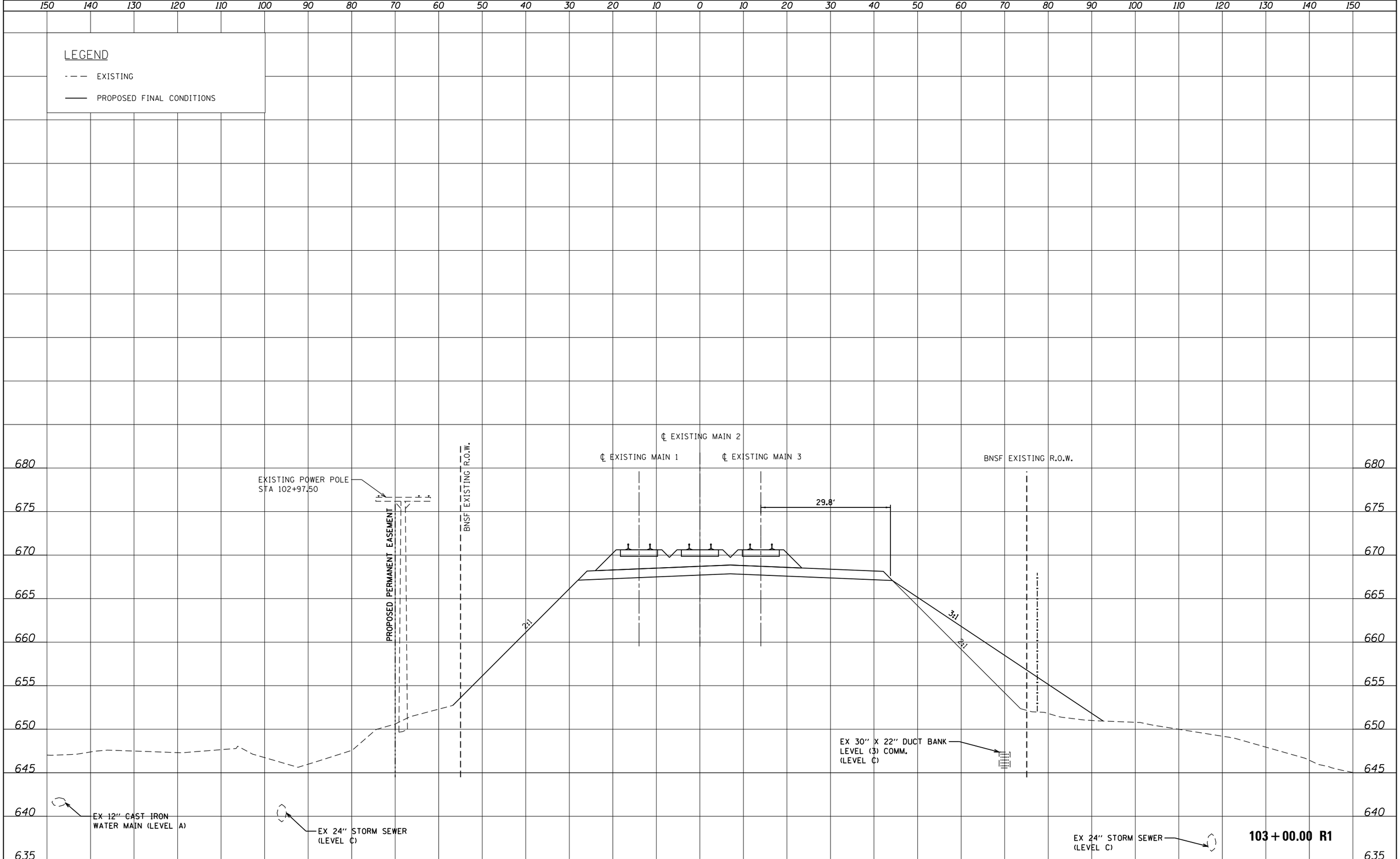

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CHECKED BY JK	DATE $DATE		

REVISIONS

NO.	DATE	DESCRIPTION

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STA. 103+00

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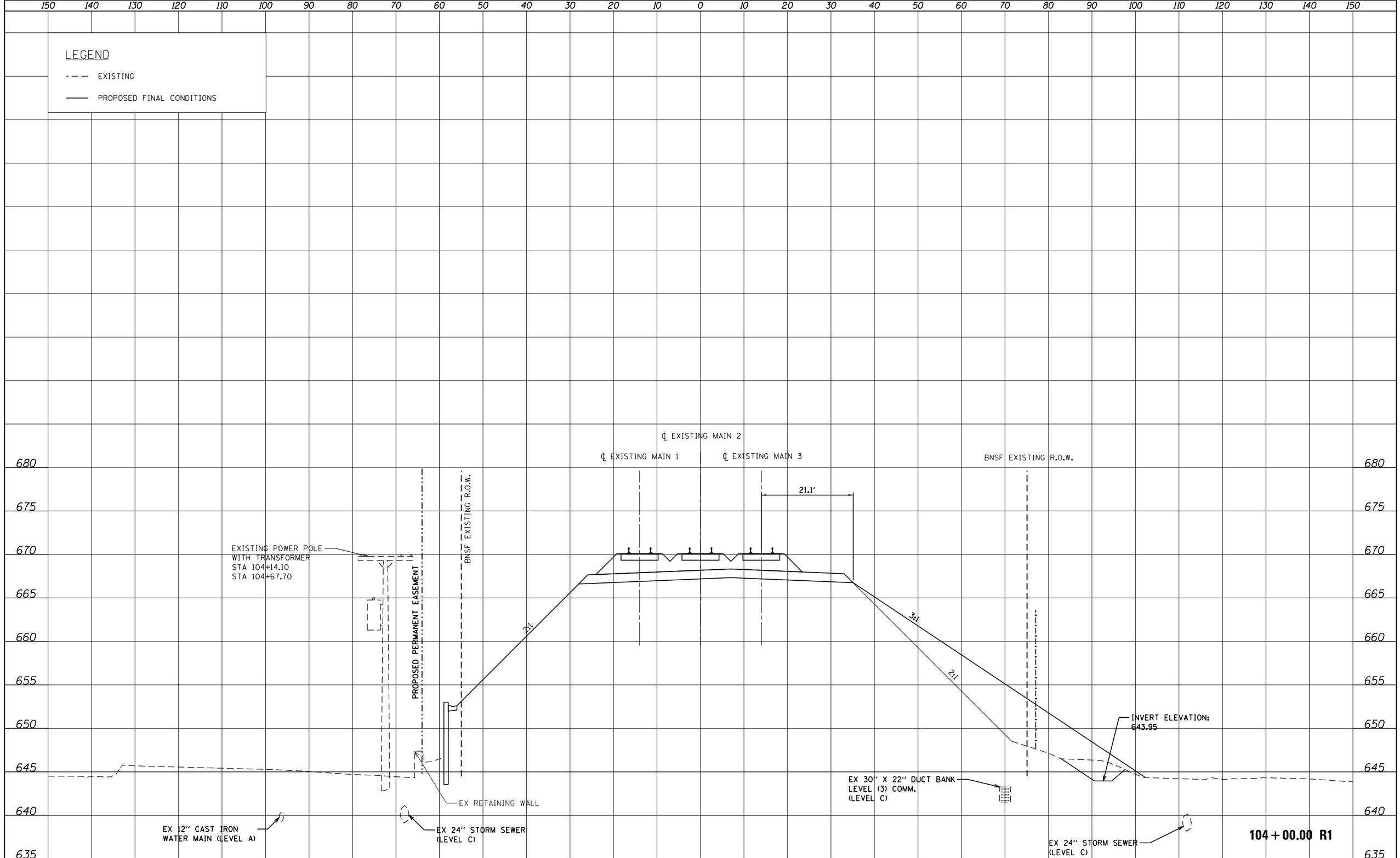

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CHECKED BY JK	DATE $DATE		

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

PROPOSED CROSS SECTIONS - RAILROAD
STA. 104+00

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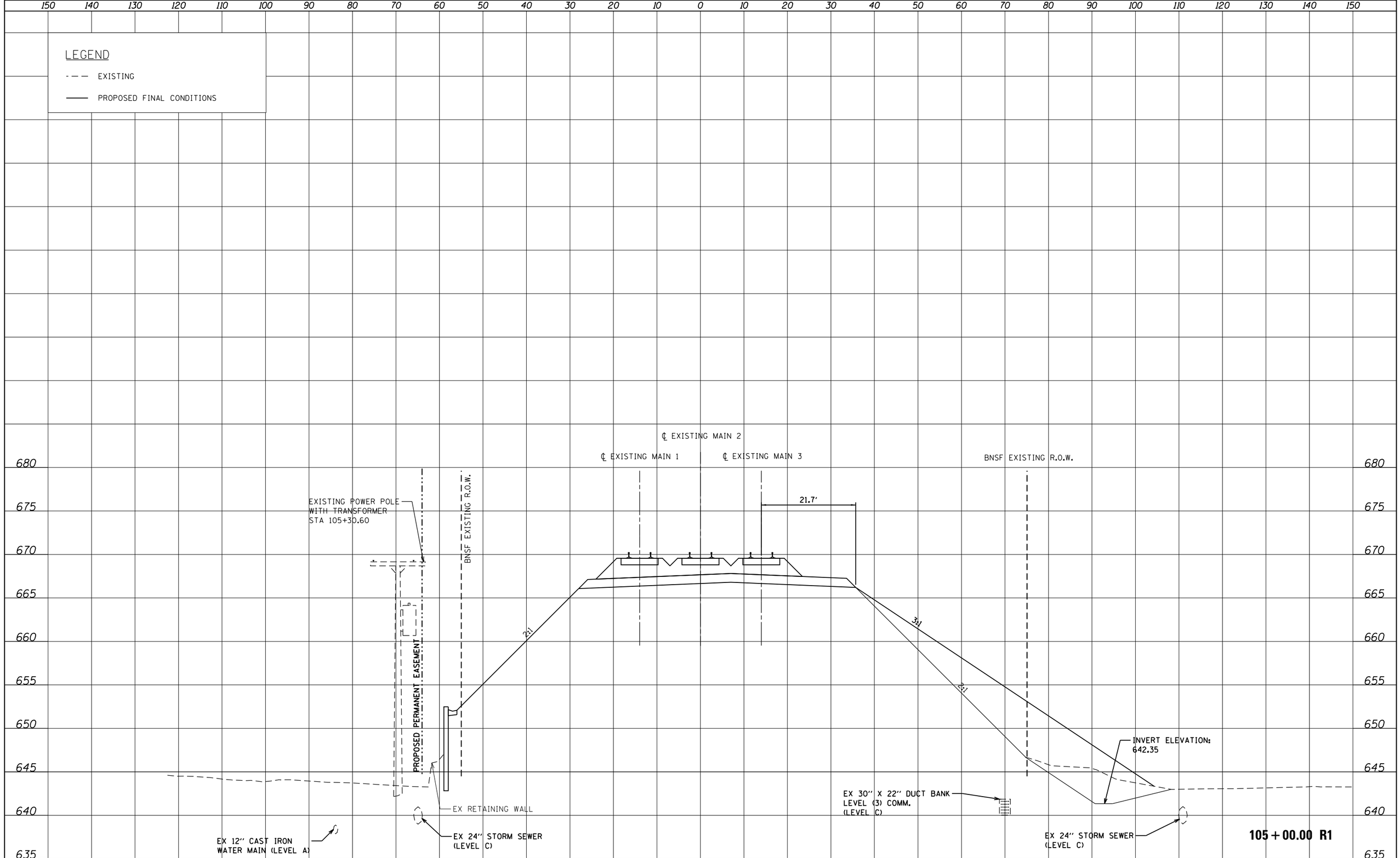

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CHECKED BY JK	DATE $DATE		

REVISIONS

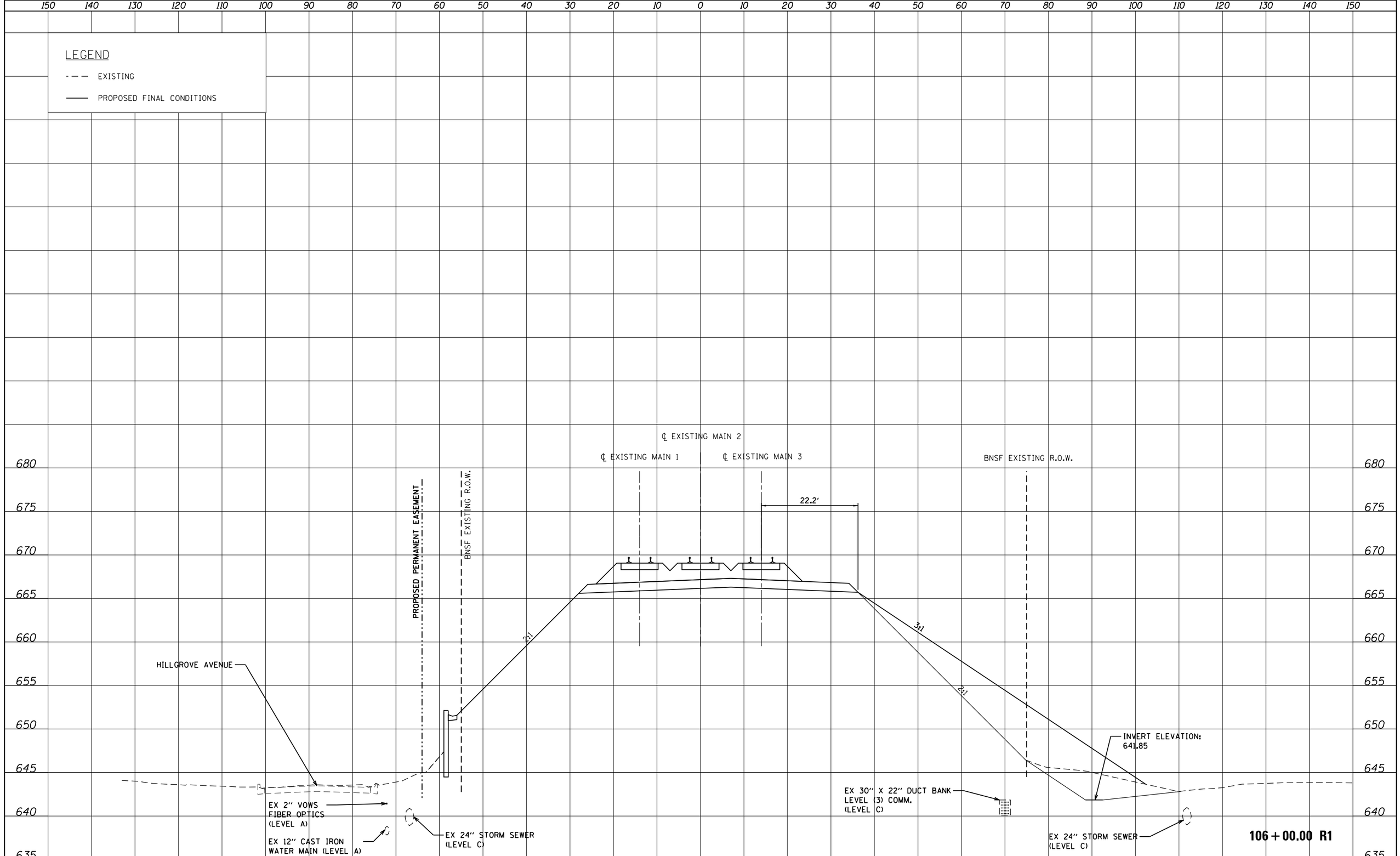
NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

PROPOSED CROSS SECTIONS - RAILROAD
STA. 105+00

SHEET NO. $PXR153$

DRAWING NO. $PXR153$ OF $TOT



DRAWN BY JAS	SCALE 1"=10' (H) 1"=5' (V)	BOWMAN, BARRETT & ASSOCIATES INC. CONSULTING ENGINEERS Chicago, Illinois 312.228.0100 www.bbandainc.com	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY 2700 OGDEN AVENUE DOWNERS GROVE, ILLINOIS 60515
CHECKED BY JK	DATE $DATE		

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

PROPOSED CROSS SECTIONS - RAILROAD
STA. 106+00

SHEET NO. $PXR154$
DRAWING NO. $PXR154 OF $TOT

APPENDIX B

ISGS WELL LOGS (3-MILE RADIUS) FROM TABLE 2

ILLINOIS STATE GEOLOGICAL SURVEY

Irrigation Well	Top	Bottom
no record	0	40
limestone	40	340
shale	340	470
limestone	470	800
sandstone	800	1030
shale, green, white, gray	1030	1065
limestone	1065	1178
Total Depth		**1178**

Casing: 12" STEEL from 0' to 1110'

Grout: PORTLAND CEMENT from 0 to 1115.

Water from sandstone at 1105' to 1178'.
Static level 557' below casing top which is 2' above GL
Pumping level 651' when pumping at 600 gpm for 24 hours

Permanent pump installed at 900'
on April 6, 2010, with a capacity of 600 gpm
Remarks: driller's est. well yield 600 gpm

Owner Address: ,
Address of well: 11700 West 31st Street
Location source: Global Positioning System verified

Permit Date: October 30, 2009 **Permit #:** 031-034

COMPANY Kerry, Todd
FARM Chicago Highlands G.C.
DATE DRILLED March 2, 2010 **NO.** 2
ELEVATION **COUNTY NO.** 36007
LOCATION SW SW SW
LATITUDE 41.83925 **LONGITUDE** -87.9135
COUNTY **Cook** **API 120313600700** **30 - 39N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Interpretation by: M. H. Smith on 03-SEP-41		
No record	0	23
Dolomite, light buff, part light gray, fine to medium, slightly vesicular	23	33
Dolomite, gray, fine to medium, partly coarse, slightly vesicular (veery slight oil show)	33	73
Dolomite, dark gray, light gray, part mottled, fine to medium	73	83
No samples	83	93
Dolomite, light gray, part light buff, fine, slightly vesicular	93	113
Dolomite, cherty, very light gray, part white, fine	113	223
No samples	223	233
Dolomite, light gray, very light buff, very fine	233	273
Dolomite, light greenish, pink, very fine	273	283
Dolomite, white, light buff, some greenish, very fine	283	313
Dolomite, slightly cherty, white to light buff, very fine, scattered glauconite	313	363
Dolomite, silty, gray, very fine, slightly argillaceous	363	383
Shale, silty, dolomitic, light green, very weak; dolomite, silty, brown to gray, very fine	383	393
Dolomite as above; little shale, silty, green, brittle	393	400
Shale, silty, dolomitic, light green, very weak; dolomite, silty, argillaceous, greenish, very fine, black specks	400	410
Shale, dolomitic, lgiht greenish gray, phosphatic nodules; dolomite, argillaceous, light greenish, very fine	410	420
Shale, dolomitic, brownish-gray, weak	420	460

Permit Date: **Permit #:**

COMPANY Miller, J. P. Art. Well

FARM Electro-Motive Corp.

DATE DRILLED January 1, 1937 **NO.** 2

ELEVATION 647GL **COUNTY NO.** 02429

LOCATION 2000'S line, 100'W line of section

LATITUDE 41.796161 **LONGITUDE** -87.858602

COUNTY Cook **API 120310242900** **10 - 38N - 12E**

Shale, dolomitic, dark brown, weak	460	500
Shale, dolomitic, brownish gray, weak	500	530
Dolomite, buff, fine, part slightly vesicular	530	640
Limestone, dolomitic, light buff, fine	640	680
Limestone, light buff, speckled, fine; calcite	680	690
Limestone as above with thin shale layers, calcareous, reddish brown, firm	690	720
Limestone, dolomitic, light buff, fine	720	730
Dolomite, light buff, fine	730	740
Limestone, light gray, brown, part speckled, fine; calcite	740	760
Limestone, dolomitic, buff, light gray, part with gray streaks, fine; calcite	760	790
Limestone, dolomitic, gray, part light gray, part dark gray streaked, lithographic to sublithographic	790	810
Limestone, dolomitic, buff, some gray, very fine	810	830
Sandstone, light gray, very fine, fine, coarse, incoherent	830	880
No samples	880	900
Sandstone, buff, very fine to fine, incoherent	900	940
Sandstone, as above, slightly silty	940	950
Sandstone, very silty, buff, fine to medium, incoherent; dolomite, sandy, light gray, very fine	950	960
Sandstone, slightly silty, buff, very fine to medium, some coarse, incoherent	960	990
Sandstone, light gray, very fine, fine, some medium, incoherent	990	1000
Sandstone, light buff gray, very fine to medium,		

incoherent	1000	1010
Sandstone, cherty, silty, fine to coarse, incoherent	1010	1043
Shale, sandy, light gray, firm	1043	1045
Dolomite, cherty, light gray, white, fine	1045	1090
Sandstone, silty, light gray, fine to coarse, incoherent, alternating with dolomite, sandy, gray, fine	1090	1120
Shale, dolomitic, red, part green, weak with dolomite nodules, light buff gray, very fine	1120	1135
Sandstone, dolomitic, light gray, white, fine to coarse, friable	1135	1140
Dolomite, slightly sandy, light gray, very fine	1140	1160
Dolomite, slightly sandy, gray white, very fine; sandstone, silty, light gray, fine to coarse, incoherent	1160	1170
Dolomite, as above, part pink	1170	1180
Dolomite, light gray, part white, fine	1180	1210
Dolomite, slightly sandy, pink, fine	1210	1270
Dolomite, pink, fine	1270	1280
Dolomite, sandy, glauconitic, pink, dark pink, fine	1280	1310
Sandstone, glauconitic, silty, gray, greenish cast, fine, friable to incoherent	1310	1340
Sandstone, argillaceous, glauconitic, silty, gray, greenish cast, fine, friable, incoherent	1340	1350
Shale, sandy, silty, slightly glauconitic, gray, greenish cast, weak	1350	1360
Shale, silty, slightly sandy, some glauconite specks, light gray, weak	1360	1380
Sandstone, dolomitic, glauconitic, light gray, medium to very coarse, compact to incoherent; little dolomite	1380	1400

Sandstone, slightly dolomitic, light gray, fine to very coarse; little dolomite, sandy, brown	1400	1430
Sandstone, very light buff, very fine to coarse, incoherent	1430	1460
Sandstone, light gray, very fine to coarse, incoherent	1460	1480
Sandstone, light gray, very fine to coarse, incoherent	1480	1500
Dolomite, sandy, silty, dark brown, fine	1500	1510
Sandstone, light gray, fine to coarse, incoherent	1510	1530
Sandstone, very silty, slightly argillaceous, light buff, fine to medium, incoherent	1530	1550
Dolomite, sandy, brown, fine	1550	1560
Dolomite, silty, slightly sandy, dark brown, fine	1560	1570
Shale, silty, slightly dolomitic, slightly sandy, some glauconite specks, gray, weak, plastic	1570	1640
Shale as above with thin sandstone layer, dolomitic, glauconitic, gray, very fine, compact	1640	1650
Shale, silty, light brown, red, green, weak	1650	1670
Shale, silty, micaceous, red, weak, plastic	1670	1700
Shale, silty, greenish gray, some red, weak, plastic with siltstone layer, brown, compact	1700	1720
Shale, silty, gray, greenish gray, plastic with siltstone layers as above	1720	1755
Sandstone, dolomitic, silty, buff gray, fine, very compact	1755	1760
Shale, gray, weak, plastic	1760	1770
Shale, gray, greenish gray, red, weak, plastic	1770	1810
Shale, slightly silty, dolomitic, glauconitic, gray, greenish tint, weak, plastic	1810	1820

No samples	1820	1830
Shale, silty, greenish gray, red, weak with siltstone layer, dolomitic, brown, compact	1830	1850
Sandstone, dolomitic, glauconite particles, gray, friable to mostly incoherent	1850	1860
Sandstone, light gray, fine to coarse, incoherent	1860	1900
No samples	1900	1910
Sandstone, gray, fine to some coarse, compact to incoherent with thin shale layers, dark brown, firm	1910	1940
Sandstone, gray, fine to coarse, incoherent; sandstone, silty, light buff, very fine, friable	1940	1950
Sandstone, as above, some with sooty appearance	1950	1975
Total depth, driller	1975	1989
Silurian	24	
Maquoketa	386	
Galena	537	
St Peter	830	
Ironton	1378	
Eau Claire	1556	
Mount Simon	1975	
Total Depth		**1989**

Survey Sample Study filed

Sample set # 2402 (23' - 1975') Received: March 3, 1937

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ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		600

Permit Date: **Permit #:**

COMPANY No Company
FARM Electro-Motive Corp
DATE DRILLED January 1, 1937 **NO.** 3
ELEVATION 647GL **COUNTY NO.** 02430
LOCATION 1980'S line, 100'W line of section
LATITUDE 41.796106 **LONGITUDE** -87.8586
COUNTY Cook **API** 120310243000 **10 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Maquoketa	350	
Galena	480	
St Peter	808	
Total Depth		**1962**

Permit Date: **Permit #:**

COMPANY Pub Serv. Co. of IL

FARM La Grange City

DATE DRILLED **NO.** 1

ELEVATION 645GL **COUNTY NO.** 01593

LOCATION 2175'S line, 140'W line of section

LATITUDE 41.810806 **LONGITUDE** -87.878824

COUNTY **Cook** **API** **120310159300** **4 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Interpretation by: Thwaites on 01-JAN-08		
Drift	0	20
Dolomite, white	20	80
Dolomite, white, chert, white	80	120
Dolomite, light gray to white	120	260
Dolomite, light gray, cherty, white	260	280
Dolomite, light gray	280	320
Shale, blue clalcareous	320	340
Shale, blue, calcareous; dolomite, gray	340	360
Dolomite, gray to hard, blue-gray	360	385
Shale, gray, calcareous	385	390
Shale, light brown, calcarous	390	400
Shale, blue, calcarous	400	480
Dolomite, light blue	480	600
Dolomite, light gray sand blue	600	630
Dolmite, gray	630	650
Dolomite, gray and blue	650	670
Dolomite, light gray	670	700
Dolomite, light gray, mottled bluish gray and dark gray	700	760
Dolomite, gray	760	770
Dolomite, gray, blue spots	770	800
Sandstone, medium to fine, light gray, calcareous	800	930

Permit Date: **Permit #:**

COMPANY Pub Serv. Co. of IL
FARM La Grange City Well
DATE DRILLED January 1, 1908 **NO.** 3
ELEVATION 645TM **COUNTY NO.** 02402
LOCATION NW NW SW
LATITUDE 41.811237 **LONGITUDE** -87.878117
COUNTY Cook **API** 120310240200 **4 - 38N - 12E**

Shale, gray	930	955
Chert, white	955	975
Dolomite, light gray, chert, white, sample may be out of place	975	1015
Shale, gray	1015	1020
Dolomite, light gray, much white chert	1020	1050
Dolomite, light gray	1050	1210
Dolomite, light gray, glauconite	1210	1230
Sandstone, very fine greenish gray, very dolomitic, glauconitic	1230	1350
Sandstone, very coarse, light gray	1350	1370
Sandstone, medium to fine, white	1370	1510
Sandstone, fine, dark gray, shaly calcareous	1510	1570
Marl, gray	1570	1740
No record, probably sandstone and marl	1740	1982.5
Silurian	20	
Maquoketa	320	
Galena	480	
St Peter	800	
Ironton	1350	
Eau Claire	1510	
Total Depth		**1983**

Survey Sample Study filed

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ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Interpretation by: L.E. Workman on 01-JAN-28		
Clay, pebbly, dolomitic, tan to black	0	20
Dolomite, light gray, weathered, very finely crystalline	20	60
Dolomite, light gray with brown spots, very fine	60	80
Dolomite, white, coarse	80	100
Dolomite, cherty, light buff, very fine	100	140
Dolomite, cherty, light gray, very fine	140	160
Dolomite, slightly cherty, brownish light gray, very fine	160	200
Dolomite, light gray and pink, very fine	200	220
Dolomite, gray, very fine	220	260
Dolomite, cherty, gray, coarse, vesicular	260	300
Dolomite, gray, very fine; some dolomite, argillaceous, brown	300	320
Dolomite, cherty, brownish gray very fine	320	365
Shale, dolomitic, dark gray	365	385
Shale, dolomitic, brown; some dolomite, brown, coarse	385	405
Shale, dolomitic, dark gray to brown	405	465
Dolomite, light brown, finely crystalline	465	565
Dolomite, light brown, medium crystalline	565	645
Dolomite, light brown, finely crystalline	645	665
Dolomite, light brown with dark spots, fine vesicular	665	705
Dolomite, gray, very fine	705	725
Limestone, mottled light to medium gray, fine grained		

Permit Date: **Permit #:**

COMPANY Cater William

FARM La Grange City Well

DATE DRILLED January 1, 1928 **NO.** 4

ELEVATION 629GL **COUNTY NO.** 01608

LOCATION 2700'N line, 1200'E line of section

LATITUDE 41.812454 **LONGITUDE** -87.863976

COUNTY **Cook** **API 120310160800** **4 - 38N - 12E**

	725	745
Dolomite, light brown very fine	745	765
Dolomite, light brown with dark spots, fine	765	785
Sandstone, dolomitic, gray, medium grained, pyritic	785	795
Sandstone, white, medium	795	845
Sandstone, yellow-brown, fine	845	865
Sandstone, buff to whitish, fine	865	1045
Sandstone, yellow-brown, fine	1045	1065
Sandstone, buff, very fine	1065	1085
Sandstone, buff, fine to medium	1085	1125
Sandstone, yellow-brown, medium	1125	1150
Shale, red, blue, gray, and white, soft; chert pebbles oolitic, white and pink; dolomite pebbles, white, weathered	1150	1205
Same, with large porportion red shale	1205	1245
Sandstone, light gray, medium; chert, oolitic, gray to white; some shale, red and blue, weak	1245	1273
Sandstone, glauconitic, dolomitic, light greenish gray	1273	1295
Same; grading to shale, dolomitic, sandy, gray	1295	1315
Sandstone, as above	1315	1335
Dolomite, sandy with coarse grains, glauconitic, light buff	1335	1355
Sandstone, slightly dolomitic, buff, medium grained	1355	1475
Sandstone, as above; a little clay brown, sandy weak	1475	1515

Sandstone, light buff, fine; a few pebbles of shale, dolomitic, brown	1515	1535
Dolomite, sandy, glauconitic, gray; shale dark gray, sand	1535	1595
Sandstone, glauconitic dolomite, gray very fine; shale, greenish gravel	1595	1635
Shale, red	1635	1655
Shale, greenish gray	1655	1675
Shale, greenish gray and red	1675	1695
Shale, green	1695	1735
Dolomite, sandy, glauconitic, light gray; shale, sandy, gray, green, and brown	1735	1785
Same; and shale, green, weak	1785	1800
Sandstone, dolomitic, glauconitic, light gray, fine	1800	1820
Dolomite, very sandy, glacuconitic, light gray; shale, dark gravel	1820	1840
Sandstone, buff, fine	1840	1910
Sandstone, light gray, fine	1910	1930
Sandstone, buff, medium	1930	1950
Sandstone, buff, coarse	1950	1960
Sandstone, buff, very fine	1960	1970
Sandstone, buff, coarse	1970	1976
Sandstone, buff, fine	1976	2003
Sandstone, buff, medium	2003	2008
Maquoketa	365	
Galena	465	

St Peter	785	
Ironton	1335	
Eau Claire	1535	
Mount Simon	1830	
Total Depth		**2008**

Survey Sample Study filed

Sample set # 814 (0' - 2008') Received: December 5, 1928

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ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Interpretation by: P.M. Busch on 01-NOV-50		
No sample	0	25
Dolomite, white, some light yellowish gray, fine to coarse	25	90
Dolomite, cherty, light yellowish gray, fine to coarse	90	130
Dolomite, light yellowish gray, fine to medium slightly porous	130	145
Dolomite, white to light yellowish gray, fine to medium, some porous; little quartz	145	185
Dolomite, light to moderate yellowish gray, fine	185	205
Silurian	25	
Total Depth		**352**

Survey Sample Study filed

Sample set # 20292 (25' - 205') Received: January 9, 1950

Permit Date: **Permit #:**

COMPANY Miller, J. P. Artesian Well Co.

FARM La Grange

DATE DRILLED October 1, 1949 **NO.** 6

ELEVATION 652GL **COUNTY NO.** 01592

LOCATION 2750'S line, 3650'W line of section

LATITUDE 41.812266 **LONGITUDE** -87.885418

COUNTY **Cook** **API** **120310159200** **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Maquoketa	323	
Galena	483	
St Peter	863	
Eau Claire	1533	
Total Depth		**1538**

Driller's Log filed

Sample set # 61642 (245' - 1545') Received: September 25, 1978

Permit Date: February 6, 1978 **Permit #:** 71108

COMPANY Wehling Well Works Inc.

FARM LaGrange Village

DATE DRILLED June 1, 1978 **NO.** 8

ELEVATION 646TM **COUNTY NO.** 25950

LOCATION 2100'S line, 200'W line of SW

LATITUDE 41.810604 **LONGITUDE** -87.878593

COUNTY **Cook** **API** **120312595000** **4 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Stratigraphic Test	Top	Bottom
Total Depth		**846**
Core #C 15251 (20' - 823') Received: January 1, 1993		

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Permit Date: **Permit #:**

COMPANY Harza Engineering Co.

FARM MSD Chicago-Mainstream Sys

DATE DRILLED October 4, 1971 **NO.** DH71-97(Q3

ELEVATION 633GL **COUNTY NO.** 34183

LOCATION SWSENENE

LATITUDE 41.801948 **LONGITUDE** -87.861195

COUNTY Cook **API** 120313418300 **9 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Silurian	20	
Maquoketa	342	
Galena	465	
St Peter	800	
Ironton	1340	
Eau Claire	1525	
Total Depth		**1902**
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY Miller, J. P. Artesian Well Co.

FARM Nazareth Acad H S

DATE DRILLED **NO.**

ELEVATION 644TM **COUNTY NO.** 02408

LOCATION NE NE NE

LATITUDE 41.818486 **LONGITUDE** -87.880892

COUNTY **Cook** **API 120310240800** **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		**1902**
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY Miller, J. P. Art. Well
FARM Our Lady Of Beth Aca
DATE DRILLED **NO.**
ELEVATION 643DM **COUNTY NO.** 02808
LOCATION W2 SW SE
LATITUDE 41.821015 **LONGITUDE** -87.889341
COUNTY **Cook** **API 120310280800** **32 - 39N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #1

Water Well	Top	Bottom
Silurian	40	
Maquoketa	385	
Total Depth		**385**

Permit Date: **Permit #:**

COMPANY Geiger, S. B. Co.

FARM Western Springs City

DATE DRILLED January 1, 1923 **NO.** 2

ELEVATION 671GL **COUNTY NO.** 02409

LOCATION 1900'S line, 100'W line of section

LATITUDE 41.809681 **LONGITUDE** -87.898334

COUNTY **Cook** **API** **120310240900** **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #3

Water Well	Top	Bottom
Silurian	35	
St Peter	810	
Ironton	1370	
Eau Claire	1528	
Total Depth		**1600**
Driller's Log filed		
Sample set # 25954 (28' - 1595') Received: December 1, 1955		

Permit Date: **Permit #:**

COMPANY Miller, J. P. Art. Well

FARM Western Springs City

DATE DRILLED January 1, 1955 **NO.** 3

ELEVATION 678GL **COUNTY NO.** 00024

LOCATION 2200'S line, 200'W line of section

LATITUDE 41.810512 **LONGITUDE** -87.898016

COUNTY Cook **API** 120310002400 **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #4

Water Well	Top	Bottom
Interpretation by: J. Brueckmann on 01-APR-65		
Silt, yellowish brown, slightly calcareous	0	10
Silt, black, very slightly calcareous	10	15
Clay, light gray, slightly calcareous, light gray dolomite fragments	15	25
Rubble (dolomite)	25	35
Dolomite, light brownish gray to white, very fine to finely crystalline, slightly cherty, trace porosity	35	75
Dolomite, light gray, little medium gray and brownish gray, extra finely crystalline, partly very finely granular, slightly cherty, very slightly argillaceous, partly siliceous, scattered specks of glauconite.	75	125
Dolomite, light gray, very finely crystalline, pure, porous	125	170
Dolomite, medium brownish gray, little dark mottling, extra fine grained, disseminated pyrite	170	205
Dolomite, light gray to brownish gray, finely crystalline, pinkish cast	205	220
Dolomite, light to medium gray, extra finely crystalline, partly fine to medium granular, partly slightly argillaceous, partly very slightly cherty, trace pink mottling	220	255
Dolomite, light brownish gray to buff, very fine to finely crystalline (poorly developed), slightly glauconitic, cherty (white)	255	275
Dolomite, light to medium brownish gray, poorly crystalline (very fine), slightly argillaceous, slightly cherty, disseminated pyrite, few shale partings, little black mottling, compact	275	325
Dolomite, grayish brown, slightly argillaceous, poorly crystalline grading to dolomite, gray, brownish gray, black mottled, very argillaceous at base	325	345
Dolomite, greenish gray, grayish brown, argillaceous; shale, light greenish gray, very weak; dolomite grains	345	370

Permit Date: **Permit #:**

COMPANY Neely, L. Cliff

FARM Western Springs

DATE DRILLED February 1, 1965 **NO.** 4

ELEVATION 643GL **COUNTY NO.** 00371

LOCATION 1100'S line, 808'E line of SW

LATITUDE 41.807172 **LONGITUDE** -87.911145

COUNTY Cook **API** 120310037100 **6 - 38N - 12E**

(350 to 365'), pale orange, coarse to very coarse, subrounded		
Dolomite, gray, dark brownish gray, argillaceous; siltstone, dark brownish gray, brittle	370	380
Shale, gray, very weak; little siltstone, as above; little dolomite, light grayish green	380	395
No samples	395	410
Shale, as above; dolomite, medium gray to grayish brown, extra fine to very finely crystalline, little dark mottling	410	415
Shale, grayish brown, brittle, with a few interbeds of gray shale; little dolomite, gray to brownish gray, medium crystalline; little buffish gray shale	415	465
No samples	465	470
Dolomite, buff to light gray, partly yellow in upper 5', fine to medium crystalline, partly black speckled, oragne speckled in upper part, disseminated pyrite, compact to slightly porous, trace shale partings	470	570
Dolomite, as above, partly yellow, iron stain	570	585
Dolomite, buff to light brownish gray, fine to medium crystalline, compact, trace porosity; trace gray sandy shale in lower 15' (caved)?	585	650
Dolomite, very fine to finely crystalline, buff to light gray, red speckled, reddish brown shale partings	650	655
Dolomite, buff, fine to medium crystalline, compact to slightly porous	655	670
Dolomite, buff, light to medium gray, very finely crystalline	670	710
Dolomite, medium grayish brown, very finely crystalline, little dark mottling increasing toward base	710	775
Dolomite, buff, very fine to finely crystalline, slightly sand at base	775	790
Dolomite, buff to gray, trace red speckling, sandy,	790	800

grading to dolomitic sandstone		
Sandstone, fine to coarse, white	800	825
Silurian	35	
Maquoketa	345	
Galena	470	
St Peter	790	
Ironton	1350	
Eau Claire	1503	
Total Depth		**1910**

Driller's Log filed
Survey Sample Study filed
Sample set # 51025 (0' - 825') Received: February 25, 1965
Sample set # 53129 (840' - 1915')

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well, Plugged	Top	Bottom
Galena	504	
St Peter	835	
Knox	1025	
Ironton	1395	
Eau Claire	1570	
Total Depth		**1585**

Driller's Log filed

Sample set # 58507 (0' - 1585') Received: April 12, 1973

Permit Date: July 7, 1972 **Permit #:** 18859

COMPANY Layne Western Co., Inc.

FARM Clarendon Hills

DATE DRILLED February 7, 1973 **NO.** 7

ELEVATION 694TM **COUNTY NO.** 03209

LOCATION 1165'N line, 465'E line of section

LATITUDE 41.800288 **LONGITUDE** -87.938508

COUNTY DuPage **API 120430320900** **11 - 38N - 11E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Total Depth		**970**
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY Gray Well Drilling
FARM McIntosh A T
DATE DRILLED January 1, 1923 **NO.**
ELEVATION 725GL **COUNTY NO.** 01680
LOCATION 2570'S line, 800'E line of section
LATITUDE 41.795572 **LONGITUDE** -87.958862
COUNTY **DuPage** **API** **120430168000** **10 - 38N - 11E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well for Business	Top	Bottom
no record	0	1540
Total Depth		**1540**

Casing: " CASING from 1' to 983'

Permit Date: **Permit #:**

COMPANY

FARM Suburban Hospital

DATE DRILLED January 1, 1958 **NO.** 3

ELEVATION 0 **COUNTY NO.** 30847

LOCATION NE SE SE

LATITUDE 41.792102 **LONGITUDE** -87.918326

COUNTY **DuPage** **API** **120433084700** **12 - 38N - 11E**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Interpretation by: G. H. Emrich on 01-AUG-58		
Till, gravely, sandy to slightly sandy, yellowish buff to buff, oxidized, calcareous	0	30
Till, sandy, gravely, brown to grayish buff, calcareous	30	53
Dolomite, white, light gray, fine to very fine, little medium, crystalline	53	60
Dolomite, light gray to light buff, very fine to fine, crystalline	60	85
Dolomite, buff to light gray, very fine to fine, little medium, crystalline	85	100
"Limestone"	100	200
Dolomite, light gray to little light buff, very fine, crystalline	200	215
Dolomite, silty, grayish buff to buffish gray, very fine, crystalline	215	245
Dolomite, white to light gray, trace green, trace pink, very fine to fine, crystalline	245	255
Dolomite, silty, buff to light buff, trace green, trace pinkish buff, very fine to fine, crystalline	255	280
Dolomite, slightly cherty, buff to light buff, very fine to fine crystalline	280	310
Dolomite, cherty, silty, buff to brown, very fine to fine, crystalline	310	325
Dolomite, silty, grayish buff to buff, very fine to fine, crystalline	325	356
Dolomite, silty, grayish buff to buffish gray, very fine to fine, crystalline, speckled (black); little shale, dolomitic, buffish gray, brittle to tough	356	375
Shale, dolomitic, gray to buffish gray, brittle; dolomite, very silty, buffish gray, very fine, crystalline	375	385
Shale, slightly dolomitic, light gray to greenish gray, weak; little dolomite, silty, brown to black, very fine, crystalline	385	395

Permit Date: **Permit #:**

COMPANY Wehling Well Works Inc.

FARM Suburban Cook Co Tb

DATE DRILLED June 1, 1958 **NO.** 3

ELEVATION 689GL **COUNTY NO.** 00156

LOCATION 1000'N line, 100'W line of section

LATITUDE 41.786645 **LONGITUDE** -87.91656

COUNTY Cook **API 120310015600** **18 - 38N - 12E**

Shale, slightly dolomitic, gray to brown, weak to brittle; little dolomite, silty, brown to gray, very fine to fine, crystalline	395	400
Dolomite, slightly silty to silty, buff to brown, very fine to fine, crystalline	400	421
Shale, slightly dolomitic, brown, weak to brittle, slightly laminated	421	435
Shale, slightly dolomitic, brown to grayish brown, weak, little brittle to tough	435	506
Dolomite, buff to buffish gray, fine, little medium, crystalline	506	550
Dolomite, light buffish gray to buff, fine to very fine, crystalline	550	560
Dolomite, buff to brown, fine to medium, crystalline	560	597
Shale, dolomitic, light gray, brittle to weak	597	600
Dolomite, buff to buffish gray, fine to medium, crystalline	600	625
Dolomite, buff to grayish buff, fine to medium, crystalline	625	652
Shale, dolomitic, light gray, white, weak to brittle	652	654
Dolomite, buff, little grayish buff, fine to medium, crystalline	654	669
Dolomite, grayish buff to grayish brown, fine to medium, crystalline, speckled (black); trace shale partings	669	674
Shale, dolomitic, light buff to light gray, weak to brittle	674	676
Dolomite, grayish buff to gray, fine to medium, crystalline	676	682
Shale, dolomitic, gray to light buff, weak, brittle	682	692
Dolomite, buff to brown to buffish gray, fine, little medium, crystalline, speckled (red, black)	692	700
Dolomite, buff to grayish buff, fine to very fine,	700	730

crystalline		
Dolomite, buff, gray, very fine to fine, crystalline, mottled	730	736
Shale, light gray, weak	736	738
Dolomite, light buff to buff, gray, very fine to fine, granular, mottled	738	740
Dolomite, silty, buff to gray, very fine to fine, granular, mottled	740	810
Dolomite, slightly sandy at base, buff, little gray, very fine to fine, crystalline, mottled	810	828
Sandstone, very dolomitic, light buffish gray, fine, little medium, rounded, frosted, compact; sandstone, slightly silty, light gray to white, medium to very fine, incoherent	828	830
Sandstone, slightly silty, white to light gray, very fine to medium, rounded, frosted, incoherent; little dolomitic sandstone, as above	830	845
Sandstone, white, medium to fine, rounded, frosted, incoherent	845	855
Sandstone, silty, slightly dolomitic, light gray, fine to very fine, rounded, frosted, incoherent to friable	855	880
Sandstone, slightly dolomitic, white to light gray, fine, rounded, frosted, incoherent, little friable	880	890
Sandstone, silty, dolomitic, light gray, fine, rounded, frosted, incoherent to friable	890	900
Sandstone, white, fine, little very fine, rounded, frosted, incoherent	900	905
Sandstone, slightly silty, slightly dolomitic, white to light gray, fine to very fine, rounded, frosted, incoherent to friable	905	915
Sandstone, slightly silty to silty, white to light gray, fine to very fine, little medium, rounded, frosted, incoherent	915	930
Sandstone, silty, light gray, very fine, little fine to	930	950

medium, rounded, frosted, incoherent to friable		
Sandstone, slightly cherty, slightly silty, light gray, fine to very fine, little medium, rounded, frosted, incoherent	950	955
Sandstone, white, very fine to fine, little medium, rounded, frosted, incoherent, interbedded with little shale, light gray to light brownish gray, weak to brittle	955	960
Shale, slightly sandy, light green to white, weak to brittle	960	965
Sandstone, cherty (oolitic), white, medium to fine, little coarse, incoherent; little dolomite, light gray to light pinkish buff, fine to very fine, crystalline	965	975
Sandstone, cherty (oolitic), slightly silty, light gray, fine, little medium to coarse, rounded, frosted, incoherent	975	978
Dolomite, cherty (oolitic), light pinkish gray to pinkish buff, fine to medium, crystalline	978	985
Dolomite, light pinkish gray to pinkish buff, fine, little medium, crystalline, slightly cherty (990-95)	985	1000
Dolomite, slightly cherty (oolitic), light buffish gray to light pinkish buff, fine to medium, crystalline	1000	1025
Dolomite, cherty (oolitic), light buffish gray to buff, fine, little medium, crystalline	1025	1040
Dolomite, light grayish buff to pinkish gray, fine to medium, crystalline	1040	1065
Dolomite, buff to grayish buff, very fine, crystalline	1065	1075
Dolomite, cherty (oolitic), buff, brown, fine to very fine, crystalline	1075	1080
Dolomite, grayish buff to brown, fine, little medium, crystalline	1080	1090
Dolomite, slightly cherty (oolitic) buff to grayish buff, fine to very fine, crystalline	1090	1115
Sandstone, white, medium to fine, little coarse,	1115	1120

subrounded, incoherent; little compact		
Dolomite, slightly sandy, light buff to pinkish buff, very fine, crystalline	1120	1155
Dolomite, light grayish buff to buff, very fine, crystalline	1155	1190
Dolomite, buff to pinkish buff, very fine, crystalline	1190	1208
Dolomite, buff to brownish gray, very fine, crystalline	1208	1255
Dolomite, slightly sandy at base, buff to grayish buff, very fine, crystalline	1255	1268
Dolomite, glauconitic, slightly sandy, pinkish buffish gray, fine, crystalline	1268	1275
Shale, slightly glauconitic, light greenish gray, weak	1275	1284
Sandstone, silty, slightly glauconitic, light gray, fine to very fine, incoherent; little sandstone, very dolomitic, glauconitic, gray, very fine to fine, compact	1284	1293
Shale, slightly glauconitic, green, weak	1293	1296
Sandstone, slightly glauconitic, light gray, very fine, little fine, incoherent	1296	1299
Shale, slightly glauconitic, light buff, greenish gray, gray, weak; little sandstone, glauconitic, silty, light gray, very fine to fine, incoherent	1299	1310
Sandstone, as above; little shale, slightly glauconitic, gray, weak	1310	1321
Shale, slightly glauconitic, slightly sandy, light grayish buff, weak	1321	1325
Sandstone, dolomitic, silty, slightly glauconitic, light grayish buff, very fine, compact	1325	1330
Shale, as above	1330	1333
Sandstone, as above	1333	1341
Sandstone, slightly glauconitic, dolomitic, silty, light buff to light grayish buff, very fine, compact; shale as	1341	1351

above		
Sandstone, dolomitic, glauconitic, light greenish gray to buff, very fine, little fine, compact; dolomite, slightly sandy, slightly glauconitic, buff to light gray, very fine, crystalline	1351	1363
Shale, slightly glauconitic, light grayish buff, light greenish gray, weak	1363	1369
Sandstone, very silty, light gray, fine to coarse, incoherent; little sandstone, very dolomitic, light buff, very fine to fine, little medium, compact	1369	1375
Sandstone, slightly silty, white to light gray, fine to medium, little coarse to very coarse, rounded, frosted, incoherent; dolomite, sandy, light buff to light pinkish buff, very fine, crystalline	1375	1390
Sandstone, silty, light buff, coarse to medium, little fine, rounded, frosted, incoherent; dolomite, sandy, light buff to brown, very fine, crystalline, oolitic	1390	1400
Sandstone, silty, light buff, coarse to fine, little very fine, rounded, frosted, incoherent	1400	1410
Sandstone, silty, light gray, fine to coarse, little very fine, rounded, frosted, incoherent; dolomite, sandy, light brown, little pinkish buff, very fine to fine, crystalline, oolitic	1410	1420
Sanstone, silty to very silty, light gray to light buff, fine to coarse, rounded, frosted, incoherent	1420	1460
Sandstone, silty, buff, medium to fine, little coarse, rounded, frosted, incoherent	1460	1475
Sandstone, light gray, medium to fine, rounded, frosted, incoherent	1475	1485
Sandstone, slightly silty, light gray, medium to coarse, little fine, rounded, frosted, incoherent	1485	1500
Sandstone, slightly silty, light gray, medium to fine, rounded, frosted, incoherent	1500	1510
Sandstone, white, fine, rounded, frosted, incoherent to friable	1510	1525

Sandstone, white, very fine, rounded, frosted, incoherent; little sandstone, dolomitic, light brown, very fine, compact	1525	1535
Sandstone, extremely argillaceous, buff, very fine, friable	1535	1540
Silurian	53	
Maquoketa	356	
Galena	506	
St Peter	828	
Ironton	1369	
Eau Claire	1535	
Total Depth		**1540**

Driller's Log filed
Survey Sample Study filed
Neutron Log filed
Caliper Log filed
Temperature Survey filed

Sample set # 31261 (0' - 1540') Received: March 6, 1958

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ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
no record	0	0
rock	0	315
shale & rock	315	410
rock	410	453
shale & rock	453	527
rock	527	560
Total Depth		**560**

Casing: 5" BLACK 15# from 0' to 150'

Grout: CUTTINGS from 0 to 150.

Size hole below casing: 4.75"

Water from rock at 530' to 560'.
Static level 150' below casing top which is 1' above GL
Pumping level 285' when pumping at 0 gpm for 3 hours

Permanent pump installed at 420'
on September 27, 1991, with a capacity of 12 gpm

Remarks: well deepened from 280 to 560

Owner Address: 5629 S. Bently Clarendon Hills, IL
Add'l loc. info: Lot: #37-40 Subdivision: Sophia Secrists
Block #5

Location source: Location from permit

Permit Date: September 17, 1991 **Permit #:**

COMPANY Knierim, Phil
FARM Young, Robert
DATE DRILLED September 26, 1991 **NO.**
ELEVATION 0 **COUNTY NO.** 29096
LOCATION SW NE NE
LATITUDE 41.785763 **LONGITUDE** -87.959169
COUNTY **DuPage** **API** **120432909600** **15 - 38N - 11E**

APPENDIX C

WESTERN SPRINGS WELL #1, #3, #4

APPENDIX C.1

WELL LOGS

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #1

Water Well	Top	Bottom
Silurian	40	
Maquoketa	385	
Total Depth		**385**

Permit Date: **Permit #:**

COMPANY Geiger, S. B. Co.

FARM Western Springs City

DATE DRILLED January 1, 1923 **NO.** 2

ELEVATION 671GL **COUNTY NO.** 02409

LOCATION 1900'S line, 100'W line of section

LATITUDE 41.809681 **LONGITUDE** -87.898334

COUNTY **Cook** **API** **120310240900** **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #3

Water Well	Top	Bottom
Silurian	35	
St Peter	810	
Ironton	1370	
Eau Claire	1528	
Total Depth		**1600**
Driller's Log filed		
Sample set # 25954 (28' - 1595') Received: December 1, 1955		

Permit Date: **Permit #:**

COMPANY Miller, J. P. Art. Well

FARM Western Springs City

DATE DRILLED January 1, 1955 **NO.** 3

ELEVATION 678GL **COUNTY NO.** 00024

LOCATION 2200'S line, 200'W line of section

LATITUDE 41.810512 **LONGITUDE** -87.898016

COUNTY Cook **API** 120310002400 **5 - 38N - 12E**

ILLINOIS STATE GEOLOGICAL SURVEY

Western Springs Well #4

Water Well	Top	Bottom
Interpretation by: J. Brueckmann on 01-APR-65		
Silt, yellowish brown, slightly calcareous	0	10
Silt, black, very slightly calcareous	10	15
Clay, light gray, slightly calcareous, light gray dolomite fragments	15	25
Rubble (dolomite)	25	35
Dolomite, light brownish gray to white, very fine to finely crystalline, slightly cherty, trace porosity	35	75
Dolomite, light gray, little medium gray and brownish gray, extra finely crystalline, partly very finely granular, slightly cherty, very slightly argillaceous, partly siliceous, scattered specks of glauconite.	75	125
Dolomite, light gray, very finely crystalline, pure, porous	125	170
Dolomite, medium brownish gray, little dark mottling, extra fine grained, disseminated pyrite	170	205
Dolomite, light gray to brownish gray, finely crystalline, pinkish cast	205	220
Dolomite, light to medium gray, extra finely crystalline, partly fine to medium granular, partly slightly argillaceous, partly very slightly cherty, trace pink mottling	220	255
Dolomite, light brownish gray to buff, very fine to finely crystalline (poorly developed), slightly glauconitic, cherty (white)	255	275
Dolomite, light to medium brownish gray, poorly crystalline (very fine), slightly argillaceous, slightly cherty, disseminated pyrite, few shale partings, little black mottling, compact	275	325
Dolomite, grayish brown, slightly argillaceous, poorly crystalline grading to dolomite, gray, brownish gray, black mottled, very argillaceous at base	325	345
Dolomite, greenish gray, grayish brown, argillaceous; shale, light greenish gray, very weak; dolomite grains	345	370

Permit Date: **Permit #:**

COMPANY Neely, L. Cliff

FARM Western Springs

DATE DRILLED February 1, 1965 **NO.** 4

ELEVATION 643GL **COUNTY NO.** 00371

LOCATION 1100'S line, 808'E line of SW

LATITUDE 41.807172 **LONGITUDE** -87.911145

COUNTY Cook **API** 120310037100 **6 - 38N - 12E**

(350 to 365'), pale orange, coarse to very coarse, subrounded		
Dolomite, gray, dark brownish gray, argillaceous; siltstone, dark brownish gray, brittle	370	380
Shale, gray, very weak; little siltstone, as above; little dolomite, light grayish green	380	395
No samples	395	410
Shale, as above; dolomite, medium gray to grayish brown, extra fine to very finely crystalline, little dark mottling	410	415
Shale, grayish brown, brittle, with a few interbeds of gray shale; little dolomite, gray to brownish gray, medium crystalline; little buffish gray shale	415	465
No samples	465	470
Dolomite, buff to light gray, partly yellow in upper 5', fine to medium crystalline, partly black speckled, oragne speckled in upper part, disseminated pyrite, compact to slightly porous, trace shale partings	470	570
Dolomite, as above, partly yellow, iron stain	570	585
Dolomite, buff to light brownish gray, fine to medium crystalline, compact, trace porosity; trace gray sandy shale in lower 15' (caved)?	585	650
Dolomite, very fine to finely crystalline, buff to light gray, red speckled, reddish brown shale partings	650	655
Dolomite, buff, fine to medium crystalline, compact to slightly porous	655	670
Dolomite, buff, light to medium gray, very finely crystalline	670	710
Dolomite, medium grayish brown, very finely crystalline, little dark mottling increasing toward base	710	775
Dolomite, buff, very fine to finely crystalline, slightly sand at base	775	790
Dolomite, buff to gray, trace red speckling, sandy,	790	800

grading to dolomitic sandstone		
Sandstone, fine to coarse, white	800	825
Silurian	35	
Maquoketa	345	
Galena	470	
St Peter	790	
Ironton	1350	
Eau Claire	1503	
Total Depth		**1910**

Driller's Log filed
Survey Sample Study filed
Sample set # 51025 (0' - 825') Received: February 25, 1965
Sample set # 53129 (840' - 1915')

APPENDIX C.2

WELL MAINTENANCE INFORMATION

2015 Well #3 MAINTENANCE PROJECT COMPLETION REPORT

Completed December 18th, 2015

Updated January 20th, 2015

GENERAL PROJECT INFORMATION

	Description
Project Name	*Well #3 Maintenance and Reconditioning*
Project Description	*The Village of Western Springs conducted reconditioning and maintenance of well #3. Maintenance included the reconditioning of the well pipe, repair to the pump/motor, and inspection of the well shaft.*
Project Manager	*Tom Healy, Layne: Water, Mineral and Energy*
Project Sponsor	*Matthew Supert, Director of Municipal Services*
General Contractor	*Layne: Water, Mineral and Energy*

	Budget	Starting	Final	Variance
Execution Date	*02/23/15*	*02/23/15*	*02/23/15*	*0 days*
Start Date	*10/05/15*	*10/05/15*	*10/05/15*	*0 days*
Finish Date	*11/20/15*	*11/20/15*	*12/03/15*	*13 days*
Days	*47*	*47*	*60*	*13 days*
Total Budget	*150,000*	*$134,783*	*$162,915.98*	*$28,132.98*

PROJECT SUMMARY

Well #3's maintenance and reconditioning was a budgeted and scheduled item for the 2015 calendar year. The Village's budget for the project was $150,000. The contractor, Layne: Water, Mineral and Energy provided the Village an original estimated budget and scope of work at $150,000. This project scope included an averaged estimated amount of work for the pipe and well reconditioning, but noted that additional costs may be required once the well pipe and pump/motor were pulled and inspected. Previous maintenance projects on well #4 and well #1 were in line with the initial cost and project estimated guidelines.

The well #3 overhaul was originally scheduled to begin in the spring of 2015. Unfortunately, the Village experienced some minor issues with well #1 that needed to be addressed prior to the commencement of the work on well #3. After the issues with well #1 were resolved, the work for well #3 was rescheduled for the fall of 2015 when system demand was anticipated to be lower.

Near the end of the summer the project's preliminary schedule for kickoff was scheduled for late October. Beginning in August and through September the Village noted a rapid decrease in the overall output and reliability of well #3, necessitating the maintenance schedule to be accelerated to early October.

The project commenced on October 5th and proceeded with approximately two weeks of removal of the well pipe from the well. Once removed the pipe was moved offsite for inspection and reconditioning which included sandblasting of the pipe and relining the interior of the pipe.

One of the bowls on the pump was found to be cracked and the spare motor at the public works yard was commissioned to be swapped in. The previous well #3 motor was repaired and will be now stored as a spare at the public works garage.

Layne crews re-mobilized on November 9th to do a cleaning of the well shaft liner and final televising of the well shaft. Installation of the well pipe commenced on November 11th and was completed on November 21st.

Flushing of the well began November 23rd and the first sample sent to the lab for testing was taken on November 25th. The Village completed all sample testing of the well on December 2nd and the well was put back in service on December 3rd.

PROJECT ISSUES

HIGH SYSTEM DEMAND AND WELL #1 USE

Throughout the duration of the project, the Village experienced abnormally high levels of demand in the system in the October and November. Typical system demand information since 2008 is listed in the table below. The 2014 data showed total plant effluent was approximately 47 million gallons for October and November, which averages approximately 1.5 millions of gallons per day (MGD).

Usage for 2015 however was abnormally high, reporting in at 59.550 and 53.942 millions of gallons for October and November. This calculates out to approximately 1.80-1.90 MGD for each month.

Village of Western Springs
Plt.Eff. Pumpage:2008-2016
Expressed in million gallons (MG)

	2008	2009	2010	2011	RO retrofit 2012	2013	2014	2015	2016	High	Avg.
Jan	40.807	41.599	42.725	39.759	38.455	47.283	56.158	52.002	25.887	56.158	42.742
Feb	39.425	38.777	37.813	35.847	36.663	47.985	45.847	47.168	0.000	47.985	36.614
Mar	42.737	41.686	37.899	36.828	39.586	59.632	47.364	52.572	0.000	59.632	39.812
Apr	40.068	41.159	37.884	35.409	41.050	48.425	45.289	47.779	0.000	48.425	37.451
May	45.162	47.452	46.320	43.051	50.710	54.292	51.089	53.086	0.000	54.292	43.462
Jun	44.889	46.714	38.965	42.573	64.621	54.008	52.715	50.362	0.000	64.621	43.872
Jly	56.838	53.713	51.809	57.144	65.463	66.370	55.906	58.311		66.370	58.194
Aug	55.854	55.867	48.247	46.976	53.522	67.196	55.864	65.953		67.196	56.185
Sep	43.535	49.812	42.414	43.029	48.350	62.810	51.156	58.812		62.810	49.990
Oct	39.247	40.562	40.753	40.736	46.767	53.637	47.647	59.550		59.550	46.112
Nov	37.106	38.816	35.485	35.551	45.974	47.397	47.036	53.942		53.942	42.663
Dec	39.793	42.027	38.400	37.981	46.011	51.444	49.823	56.262		56.262	45.218
Total	**525.461**	**538.184**	**498.714**	**494.884**	**577.172**	**660.479**	**605.894**	**655.799**	**25.887**		**542.315**
ADC	**1.436**	**1.474**	**1.366**	**1.356**	**1.577**	**1.810**	**1.660**	**1.797**	**0.071**		**1.486**
Note: Average Daily Consumption (ADC)					66 M breaks	111 M breaks	71 M breaks	49 M breaks			

Well #4 has an output of is approximately 1.1 million gallons per day after treatment. Even during our historical usage some amount of well #1 would have been needed to meet the 1.5 MGD for system demand. The abnormally high demand for the months of October and November required well #1 to be used to supplement the system at a rate much higher than anticipated. Output rates for well #1 were similar to and, in some cases exceeded those comparable monthly usages that were observed during the RO construction period during the summer of 2012.

Village of Western Springs
Well #1 Pumpage:2008-2016
Expressed in million gallons

	2008	2009	2010	2011	Raw 2012	2013	2014	2015	2016	High	Avg.
Jan	0.062	0.032	0.064	0.067	0.064	0.060	0.058	2.677		2.677	0.386
Feb	0.030	0.064	0.064	0.067	0.654	0.061	0.056	4.203		4.203	0.650
Mar	0.064	0.064	0.064	0.058	0.865	0.104	0.057	1.810		1.810	0.386
Apr	0.064	0.143	0.138	0.063	2.846	0.090	0.041	1.496		2.846	0.610
May	0.063	0.063	0.065	0.063	8.364	0.061	0.052	2.395		8.364	1.391
Jun	0.062	0.062	0.064	0.058	16.527	0.059	0.049	1.664		16.527	2.318
Jly	0.063	0.064	0.069	0.068	8.062	0.060	0.048	0.574		8.062	1.126
Aug	0.069	0.065	0.067	0.068	10.835	0.065	0.048	0.419		10.835	1.455
Sep	0.094	0.063	0.064	0.064	6.140	0.058	0.047	0.842		6.140	0.922
Oct	0.539	0.063	0.064	0.065	6.997	0.073	0.000	17.022		17.022	3.103
Nov	0.127	0.064	0.127	0.064	2.853	0.057	0.410	13.568		13.568	2.159
Dec	0.032	0.063	0.064	0.085	0.062	0.099	2.104	0.903		2.104	0.427
Total	1.269	0.810	0.914	0.790	64.269	0.847	2.970	47.573			

The cause for the higher system demand is not entirely known at this time. Early observations, by Village staff, speculated that a warm and dry autumn may have been a contributing factor to the increased need for the well and subsequently watering restrictions were enacted in an attempt to alleviate some of the demand on the system.

Further evidence, at this point, would indicate that additional investigation is needed for the high amounts usage during the past two months. Due to the severity of this usage, there is a high probability that there may be an undiscovered leak in the distribution system. The Village typically conducts an annual leakage survey of the distribution pipe in the spring to locate leaks in the system which may have surfaced. Due to the high output numbers currently observed, staff will begin to schedule a leak detection survey after the first of the year, if weather conditions allows.

CRACKED BOWL FOR WELL #3 PUMP

The 400 horsepower Byron Jackson Type H submersible pump was pulled, cleaned, sandblasted and inspected. Upon disassembly and inspection of the pump it was discovered that the bronze casing failed due to corrosion, resulting in the check valve flappers and a holding pin falling into the top of the bowl. These pieces caused the S.S. impeller shaft to become worn down into an hour glass shape and eventually breaking off. These pieces became lodged in the top bowl casing and wore down the underside of the casing vanes causing a split. This was the cause of the drop in production for the well observed in late August and through September.

Work required the replacement of two 23MQ all bronze bowl castings and two 12MQ bronze impellers. While materials were being sourced the standby motor was taken from storage at the public works facility and placed into service. The current Type H motor will now be placed into storage as a backup.

PROJECT TIMELINE DELAYS

- 11/12 – High Winds
- 11/13 – High Winds
- 11/17 – Storm conditions
- 11/19 – Electrical test error, had to remove some pipe. Found pinhole in cable insulation. Repaired.
- 11/21 – Well pipe installation was completed, flushing of well began.
- 11/23 – Issue with control transformer on electrical panel. Contacts fixed that afternoon.
- 11/24 – First sample taken and sent to lab. Village needed to get its samples cleared. Thanksgiving holiday impacted timing since lab was closed 11/25-11/29.

ADDITIONAL OBSERVATIONS

Project Start Date

The well #3 maintenance project was a project that was scheduled and budgeted for the 2015 calendar. Typical well maintenance for all of the Village's wells happens on a 10-15 year cycle. Well #1 received maintenance in 2014 and Well #4 last received maintenance in 2010. With the completion of well #3 maintenance in 2015 the Village does not anticipate additional maintenance until 2020-2025 for well #4.

The project was initially scheduled to take place during the spring of 2015, but was postponed until the fall due to some reliability issues associated with well #1's transmission pipe running under the railroad tracks near Wolf Road and Hillgrove Avenue. There was concern that the age of the pipe may be problematic and any issues with that pipe could negatively affect operations on the BNSF railway. During the summer of 2015, the Village conducted lining of the transmission main for well #1 to ensure the reliability and integrity of that transmission main under the BNSF right of way.

Once the lining was completed, the follow up schedule for the well #3 project was to begin in late October or early November, which is typically when system demand decreases. This would have allowed the Village to minimize the use of well #1 during the maintenance period. Plant operators saw a marked decrease in the production of well #3 through the end of August and into September, which caused the Village to accelerate the maintenance program on well #3. This will lead to two primary follow up actions which need to be explored by the Municipal Services Department.

Explore causes of high demand

The largest immediate concern is the observed increased system demand. Investigations will need to be made as to what is causing the plant to need to output more water. This process will begin with a leak detection survey conducted by the Village, which is an acoustic monitoring survey to find underground leaks within the system. Once completed, follow up assessment to system usage will be required.

The Village has seen an overall upward trend in water output requirements to the system since 2008. It has been speculated, but not fully investigated, as to whether the continual change over in the Village's housing stock to large square footage homes is leading to some of the increased demand. While overall plant output has continued to rise over the past decade, overall billed volumes have not necessarily kept pace. It is difficult at this point to make a correlation to the percentage of the increase to new homes, largely due to the age and types of meters installed. While this issue may not be directly related to the well #3 maintenance, it is an issue that should be explored further by the Village in the coming year.

Potential options to alleviate well #1 usage

The largest single issue associated with the current well #3 maintenance was the need for well #1 to go to distribution. Well #1 currently cannot go through the RO treatment plant because it cannot provide the necessary feed pressure to get through the plant. Increased need for the use of well #1 resulted in significant iron and hardness problems for some residents in the Village. The Village has, on numerous occasions, explored various replacement options for well #1. Future capital improvement projects have identified possible ways to address the aging well, which was constructed in 1924.

Well #3 & #4 Pipe Replacement

One of the largest lead time issues associated with the well maintenance is the reconditioning of the well pipe. During the standard maintenance procedure, the pipe is removed from the site for inspection, reconditioning and relining. This process takes 2-4 weeks depending upon the volume of pipe that needs to be reconditioned. It may be possible during future maintenance cycles to purchase pipe ahead of the scheduled maintenance and replace any pipe that is needed opposed to reconditioning it. This process may decrease the maintenance period by several weeks.

Current pipe prices are approximately $47-$50 per lineal foot which may add as much as $80,000 to the maintenance process.

Treatment options for well #1.

While well #1 cannot run through the water treatment plant, potential permanent and temporary treatment options should be explored for the well site. Any treatment options would likely not provide the full softening capabilities of the RO plant, but they could possibly allow for the Village to address some of the iron issues that were experienced during this maintenance period.

The major issues with any mobile treatment options are the site location and size. The well is located in a very small location near the BNSF right of way. Very little existing open space is available around the well. The construction of any facilities within the BNSF right of way is probably unfeasible and the proximity of Wolf Road and several major sewer systems through that area also present challenges. Expansion to the east into the commuter parking facility may be possible, or in the case of a temporary treatment situation the closure of Burlington Avenue may be feasible.

It will also need to be determined if any treatment options, especially temporary or mobile treatment equipment, limits the potential output of the well.

No cost options are known at this time for either a temporary or permeant treatment system.

Construction of well #5

The construction of a 5th well within the Village is an item that has been discussed on numerous occasions as far back as the 1980's. This past year, beginning in May and concluding in October of 2015, the Infrastructure Commission reviewed feasible locations within the Village for a potential well #5.

This option would allow for the Village to completely eliminate the existing shallow well and as a result the issues associated with running it. The new deep well would also allow for the Village to continue to run two wells through the water treatment plant while another well is offline. This option, however, is also the most expensive putting the construction of the 5th well at approximately $1-1.5 million. An additional $1-$2 million may be required depending upon the location of the well, the installation of a transmission main, and the possibility of land acquisition.

Additional Water Sampling in the Community

In response to resident questions from the December 7th Board meeting, the Water Department will be expanding its water sampling and reporting through the beginning of the new year. Samples will be taken at each subdivision within the community at two week intervals, and the results will be made available on the Village's website at wsprings.com/water. The expanded sampling will continue as needed for the first 2-3 months into 2016. Village staff is currently in the process of confirming sample sites and scheduling sampling times with residents in each subdivision.

The following data will be sampled and reported.

1. Total Hardness
2. Calcium Hardness
3. Alkalinity
4. Iron
5. pH
6. Turbidity
7. Fluoride
8. Total Dissolved Solids
9. Total Chlorine
10. Free Chlorine
11. BacT

Appendix A: Project Event Timeline

09/17/15	Tower Topics Mailed to residents with notification of well maintenance
10/05/15	Commencement of project and shutdown of well #3. Well #1 begins going to distribution.
10/05/15	Removal of well #3 pipe, pump and motor begins.
10/12/15	Village begins receiving calls of discolored water.
10/15/15	High system usage is observed .
10/19/15	Removal of pump, motor and well pipe is completed. Offsite work begins.
10/21/15	Village implements watering restrictions to alleviate system demand.
10/22/15	FAQ is posted on Village website regarding well maintenance.
11/05/15	Well repair rig is moved back onsite in preparation for pipe installation.
11/09/15	Clean and brush well liner
11/11/15	Re-televise well, conduct final inspection.
11/11/15	Reinstallation of well pipe begins.
11/12/15	Work postponed due to high wind conditions.
11/13/15	Work postponed due to high wind conditions.
11/16/15	Installation of pump and motor.
11/17/15	Work postponed due to severe weather.
11/18/15	Majority of pipe installation completed.
11/19/15	Work crews find electrical fault and must remove pipe.
11/20/15	Pipe pulled and issue found with a pinhole in insulation cabling. Pipe installation resumes.
11/21/15	Pipe installation is completed.
11/23/15	Flushing of well begins for testing. Fault found in control transformer.
11/24/15	Flushing of the well.
11/25/15	First sample taken to lab for testing. Flushing continues.
11/30/15	Lab closed over Thanksgiving holiday. Flushing continues and additional sample taken.
12/02/15	Confirmation of two passed samples. Reassembly of well head begins.
12/03/15	Well begins going back to distribution. Construction of enclosure begins.
12/04/15	Enclosure of well building is completed.

Appendix B: Cost Summary

Please note that the current cost summary is preliminary as of 12/18/15, and changes may be made as invoices and work is reviewed and finalized.

Date:	QNTY	UNITS	DESCRIPTION	PRICE	TOTAL
5-Oct	8.5	hr	Large Pump Service Rig & 3 man crew - mob & setup equipment	$ 563.00	$ 4,785.50
6-Oct	8	hr	Large Pump Service Rig & 3 man crew - pulling pump	$ 563.00	$ 4,504.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
	1	LS	Power tong usage	$ 450.00	$ 450.00
7-Oct	8	hr	Large Pump Service Rig & 3 man crew - pulling pump	$ 563.00	$ 4,504.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
	1	LS	Power tong usage	$ 450.00	$ 450.00
8-Oct	8	hr	Large Pump Service Rig & 3 man crew - Finish pulling pump	$ 563.00	$ 4,504.00
	3	hrs	Byron Jackson Technician - mob to site and remove broken motor coupling bolt	$ 204.00	$ 612.00
	1	hrs	Pump Serviceman & helper - load scaffolding & motor vessel for BJ motor servicing onsite	$ 318.00	$ 318.00
9-Oct	8	hr	Large Crane & 2 man crew - Service motor; load motor, bowl, & cable; & haul/unload in yard.	$ 420.00	$ 3,360.00
12-Oct	8	hrs	Large Crane & 3 man crew - Load pipe at job & haul/unload in yard.	$ 563.00	$ 4,504.00
13-Dec	1	LS	Televison Survey of well	$ 1,550.00	$ 1,550.00
			MACHINE SHOP/YARD LABOR		
			unload pump in yard for inspection; Disassemble, clean & inspect bowl assembly;		
			Perform prelim checks of 400HP BJ motor; & power wash & sandblast 8" T&C pipe for inspection.		
	8	hrs	Machinsts	$ 169.00	$ 1,352.00
	6	hrs	Helper - assist is bowl disassembly	$ 140.00	$ 840.00
	6.5	hrs	Sandblast crew	$ 339.00	$ 2,203.50
	6	hrs	Serviceman & helper - power washing	$ 318.00	$ 1,908.00
	8	hrs	Byron Jackson motor technician	$ 175.00	$ 1,400.00
9-Nov	8	hrs	Large Pump Service Rig & 3 man crew - setup and prepare to brush the 12" liner	$ 420.00	$ 3,360.00
10-Nov	4.5	hr	Large Pump Service Rig & 3 man crew - finish setup equipment & brush liner	$ 420.00	$ 1,890.00
11-Nov	1	LS	Re-Televise the well	$ 1,550.00	$ 1,550.00
12-Nov	3.5	hr	Yard Crane & 3 man crew - loading in yard	$ 409.00	$ 1,431.50
14-Nov	8	hr	Large Pump Service Rig & 3 man crew -	$ 563.00	$ 4,504.00
	8	hr	Large Crane	$ 102.00	$ 816.00
16-Nov	8	hr	Large Pump Service Rig & 3 man crew -	$ 563.00	$ 4,504.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
	1	LS	Power tong usage	$ 450.00	$ 450.00
18-Nov	10	hr	Large Pump Service Rig & 3 man crew -	$ 563.00	$ 5,630.00
	10	hr	Additional Helper	$ 143.00	$ 1,430.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
	1	LS	Power tong usage	$ 450.00	$ 450.00
19-Nov	5	hr	Large Pump Service Rig & 3 man crew - finish reinstalling pump	$ 563.00	$ 2,815.00
	5	hr	Additional Helper - finish reinstalling pump	$ 143.00	$ 715.00
21-Nov	8	hr	Large Pump Service Rig & 3 man crew - Set pump down, make splice, get all ready to test on Monday	$ 563.00	$ 4,504.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
23-Nov	8	hr	Large Pump Service Rig & 3 man crew - hook up pump-off eqm't, start loading, & wait on starter issue to start	$ 563.00	$ 4,504.00
	2	hr	Serviceman w/ Service Truck	$ 204.00	$ 408.00
24-Nov	6	hr	Pump Serviceman & Helper - setup and run pumping test	$ 318.00	$ 1,908.00

24-Nov	6	hr	Pump Serviceman & Helper - setup and run pumping test	$ 318.00	$ 1,908.00
25-Nov	6	hr	Large Pump Service Rig & 3 man crew - Set spool; tear down rig and move out; and flush well.	$ 563.00	$ 3,378.00
30-Nov	7	hr	Serviceman w/ Service Truck - pumping to take bacti samples	$ 204.00	$ 1,428.00
1-Dec	6	hr	Serviceman w/ Service Truck - pumping to take bacti samples	$ 204.00	$ 1,224.00
2-Dec	6	hr	Serviceman w/ Service Truck & Helper - install building beam, re-connect piping, load pump-off eqm't; & final c	$ 347.00	$ 2,082.00
			MACHINE SHOP/YARD LABOR		
			Repairs bad pipe thread ends; replace both surge control valves; replace bad pipe couplings;		
			Fully inspect 400HP Byron Jackson motor; sandblast & epoxy coat all pipe, in & out; replace		
			bad pipe; rebuild & reassemble all bronze bowl; re-furbish surface plate; & BJ motor		
			work (work on existing & prep for shipment back to factory; & check over Village spare for use)		
	48.5	hrs	Machinsts	$ 169.00	$ 8,196.50
	14	hrs	Helper	$ 140.00	$ 1,960.00
	14	hrs	Machinist w/ pipe rethread lathe	$ 175.00	$ 2,450.00
	3	hrs	Machinist w/ mill - machine holes in pump house I-Beam {now easily removable}	$ 169.00	$ 507.00
	881	ft.	Sandblast crew - Sandblast & epoxy coat pipe, inside & out	$ 25.00	$ 22,025.00
	3	hrs	Serviceman & helper - start loading pump	$ 318.00	$ 954.00
	18	hrs	Byron Jackson motor technician - final inspection of motor pulled; inspect spare, & prep motor to go back to B	$ 175.00	$ 3,150.00
				Subtotal Labor	**$ 127,509.00**

Date:	QNTY	UNITS	DESCRIPTION	PRICE	TOTAL
	1	ea	Byron Jackson 2300 volt flat cable	$ 6,461.00	$ 6,461.00
	6	ea	8" 8 round pipe couplings	$ 198.00	$ 1,188.00
	4	ea	8" 8V pipe couplings with API monogram	$ 187.00	$ 748.00
	2	ea	8" 8V surge control valves	$ 1,316.00	$ 2,632.00
	2	ea	12MQ good, used bronze impellers	$ 600.00	$ 1,200.00
	2	ea	12MQ good, used bronze bowl castings	$ 1,600.00	$ 3,200.00
	302	ft.	8" Schedule 40 T & C Line Pipe	$ 47.00	$ 14,194.00
	8	gals	Byron Jackson motor oil	$ 29.00	$ 232.00
	1762	ft.	1/4" Toro plastic airline	$ 0.50	$ 881.00
	1	ea	Spilce kit for new Byron Jackson flat cable	$ 54.30	$ 54.30
	101	LBS	Bronze stock for wear rings	$ 9.00	$ 909.00
	1	ea	1-15/16" S.S. impeller shaft	$ 1,260.00	$ 1,260.00
	2	ea	1-15/16" bronze suction bushings - F013BRZ	$ 137.84	$ 275.68
	2	ea	1-15/16" bronze discharge bushings - BJ937	$ 89.60	$ 179.20
	12	ea	1-15/16" bronze intermediate bushings	$ 143.30	$ 1,719.60
	2	ea	200/460 airline guages	$ 24.00	$ 48.00
	1	ea	100 psi pressure guage	$ 14.00	$ 14.00
	16	ea	Byron Jackson 12MQ casting o-rings	$ 13.20	$ 211.20
				Subtotal	**$ 35,406.98**
				Project Total	**$ 162,915.98**

Please note that the current cost summary is preliminary as of 12/18/15, and changes may be made as invoices and work is reviewed and finalized.

APPENDIX D

WELL #4 PHOTOGRAPHIC DOCUMENTATION

PHOTO 1
Date: 09/05/2018

Well #4, located on west side of pump building, facing northeast.

PHOTO 2

Piping of Well #4 inside pump building, facing west-southwest.

APPENDIX E

WESTERN SPRINGS WATER QUALITY 2015-2017

THE VILLAGE OF WESTERN SPRINGS WATER SYSTEM
FACT SHEET

The Village of Western Springs Water System

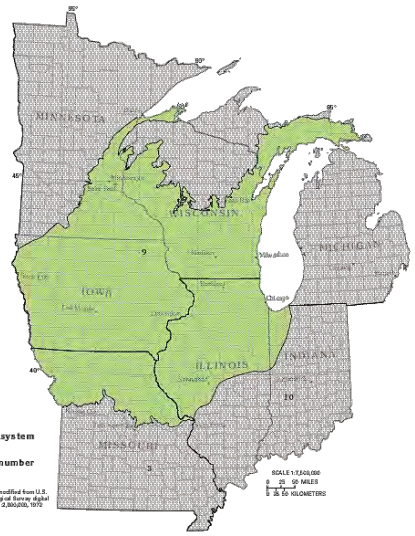
WHERE DOES YOUR WATER COME FROM?

Since the development of the Western Springs' water system in 1882, the Village has obtained its water from groundwater sources. During the early years these included springs; however, in subsequent years, the Village became dependent upon well water.

Since the late 1950s the Village has become dependent on its deep wells. The Village has three wells, two deep wells and one shallow well. Of the two deep wells, one draws water from the Galesville aquifer and the other draws water from both Galesville and Mt. Simon aquifers. These aquifers are part of the Cambrian-Ordovician aquifer system which consists of underground rivers passing through sandstone formations which extend north into Wisconsin. Many communities throughout the upper Midwest obtain their drinking water from this aquifer system.

Figure 20. The Cambrian–Ordovician aquifer system, which consists of predom-inantly sandstone aquifers separated by poorly permeable confining units, extends over a large part of the north-central United States.

Modified from Young, H.L., 1992b, Hydrogeology of the Cambrian-Ordovician aquifer system in the northern midwest, United States, with a section on Ground-water quality by D.I. Siegel: U.S. Geological Survey Professional Paper 1405–B, 99 p.



HOW DOES YOUR WATER GET TO YOU?

The Village's current water production system consists of three wells, a treatment plant, three storage tanks, the connecting water mains and the associated equipment. The Village has a 2 million gallon standpipe located near Lyons Township High School and a 1 million gallon elevated tank located at Spring Rock Park, both of which pressure the current system. The Village has over 52 miles of water main, of which approximately 77% is over 40 years in age.

The Village completed a major renovation of the water treatment plant in 2013 which transitioned the Village from a lime softening treatment process to a low pressure reverse osmosis process (LPRO). The Village of Western Springs' average daily consumption levels range from approximately 1.2 – 2.8 millions of gallons per day (MGD) and the treatment plant is able to produce nearly 600 million gallons of water per year.

Well #1, which is only used in emergencies, is a shallow well, drilled to a depth of 385 feet below the surface within the St. Peter Formation. Well #1 was drilled in 1924 and currently has a capacity just under 780 gallons per minute (GPM) or a maximum of 1.1 MGD. This well has a high total hardness (approximately 55 grains, 942 mg/L) and iron, but meets all federal primary drinking water standards. When this well is operated to distribution, residents will often notice a change in the water quality.

Well #3 is one of the primary sources of water for the Village. Drilled in 1955 to the Ironton-Galesville formation to the depth of approximately 1,600 feet, well #3 is a deep well and the production capacity is approximately 1,300 GPM or a maximum of 1.8 MGD. The well contains natural fluoride, low sodium and meets all other measurements for water quality. It also has an emergency diesel generator to supply electricity to the well, if needed. Well #3 was recently out of service due to unforeseen circumstances.

Well #4 is a deep well drilled in 1966 to the Mt. Simon formation and is approximately 1,900 feet below the surface. This well has a production capacity of approximately 1,100 GPM or a maximum of 1.6 MGD. Total hardness on this well is lower than well #3. The well was rehabilitated in 2010, 1998 and prior to that in 1990.

THE TREATMENT PROCESS

Beginning in 2011, the Village transitioned from lime softening to low pressure reverse osmosis. Low Pressure Reverse Osmosis (LPRO) is a water purification technology that uses a semipermeable membrane to remove larger particles from drinking water. Reverse osmosis can remove many types of molecules and ions from solutions, including bacteria, and is used in both industrial processes and the production of potable water. The technology is most commonly found in desalination plants and other rural treatment plants in the United States.

After the feed water is processed through the Village's RO trains no more than 45% of the raw water from the deep wells is bypassed and blended back into the RO water to allow for adjustments to taste and texture. The water is then chlorinated before going out to the Village's distribution system.

The Village of Western Springs Water System

WATER TESTING AND DATA

Currently, Water Department staff performs testing on the finished water leaving the plant four times a day. This testing includes: total hardness, calcium hardness, alkalinity, iron, pH, turbidity, fluoride, TDS, total chlorine, and free chlorine. The Village also conducts weekly BacT and chlorine residual samples at various locations in distribution. Details regarding those samples and sampling locations can be found on the IEPA's Water Watch Website.

The following data is required to be submitted to the IEPA on the listed timelines below. All sample data submitted to the IEPA is conducted by a third party, independent lab.

DISTRIBUTION

Program	# of Samples	Frequency
Coliform	15	Monthly
Lead/Copper	30	Every 3 Years
Disinfection By-Products	2	Yearly

TREATMENT PLANT- FINISHED WATER

Program	# of Samples	Frequency
Coliform	1	Weekly
Combined Radium	1	Yearly
Gross Alpha	1	Every 3 Years
Inorganics	1	Every 3 Years
Nitrate	1	Yearly
Nitrite	1	Every 3 Years
Synthetics	2	Every 3 Years
Vinyl Chloride	1	Every 3 Years
Volatiles	1	Every 3 Years

WELL #1, #3, AND #4- RAW WATER

Program	# of Samples	Frequency
Coliform	1	Monthly
Inorganics	1	Every 3 Years
Nitrate	1	Every 3 Years
Nitrite	1	Every 3 Years
Combined Radium	1	Every 3 Years
Synthetics	1	Every 3 Years
Vinyl Chloride	1	Every 3 Years
Volatiles	1	Every 3 Years

Per the Safe Water Drinking Act the Village is required to produce an annual report known as the Consumer Confidence Report (CCR). A CCR is an annual water quality report delivered by community water systems to their customers. The CCR includes information on source water, the levels of detected contaminants, compliance with drinking water rules, and some educational language. The reports are due to customers by July 1st each year. The Village mails a copy to each address, posts the report in the Village Hall Lobby, and makes it available on the Water Department webpage.

UPDATE ON WELL #3 REPAIRS

Restoration of Well #3 was completed on June 2nd and the well was brought back online. Watering restrictions were lifted on June 5th. Between June 2nd and July 13th, Well #3 was being chlorinated and run to the reservoir on a supplemental basis dependent upon demand. Well #4 was softened through the RO plant. As of Thursday, July 13th, we have been able to soften Well #3 through the RO plant, as well, on a supplemental basis.

Some additional repairs to the lightning suppression and controls systems are still required and parts are currently under manufacture; however, water quality should be returning to normal.

WATER QUALITY DATA

Well #4...	Hardness(avg)	Iron (avg)
with Well #1	265	0.38
with Well #3 chlorinated	184	0.15
with Well #3 treated w/ RO	113	0.06

CONTACT INFORMATION

If residents are experiencing issues with the taste or quality of the water at their home they are encouraged to contact the Water Department at 708-246-1800 x 214. Plant operators can follow up regarding various issues and if needed take a water sample for testing.

Erin V Duffy
Water Treatment Plant Superintendent
708.246.1800 x214
eduffy@wsprings.com

ANNUAL WATER QUALITY REPORT / CONSUMER CONFIDENCE REPORT 2017

VILLAGE OF
WESTERN SPRINGS

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Where Does My Water Come From?

Since the development of the Western Springs' water system in 1882, the Village has obtained its water from ground water sources. During the early years these included springs from which the community derives its name. In subsequent years, the Village became dependent upon well water and since the late 1950's, the primary water source has been two deep wells.

At the present time, the Village has three wells, two deep and one shallow. Of the two deep wells, one draws water from the Galesville aquifer and the other draws water from both Galesville and Mt. Simon aquifers. These aquifers are underground rivers passing through sandstone formations which extend north into Wisconsin. The shallow well draws water from the Niagaran aquifer, an underground river that passes through a limestone formation.

Source Water Assessment Summary

The Source Water Assessment has been completed and the Illinois EPA has determined that "Western Springs' wells #3 and #4 source water is not susceptible to contamination. This determination is based on a number of criteria including: monitoring conducted at the wells, monitoring conducted at the entry point to the distribution system, and the available hydro-geological data on the well."

To view a summary version of the completed Source Water Assessment, including: Importance of Source Water; Susceptibility to Contamination Determination; and documentation/recommendation of Source Water Protection Efforts, you may access the Illinois EPA web site at **www.epa.state.il.us/cgi-bin/wp/swap-fact-sheets.pl**.

Use of Outdoor Water

This summer enjoy the use of water for outdoor purposes without any restrictions; however, please practice conservancy.

Water Bill Payment Made Easy

Automatic payment of your water bill is available to all residents. Your payment is electronically withdrawn from the account of your choice on the due date of your water bill.

Interested? The application is available at www.wsprings.com or the Village Hall.

For more information, please contact the Finance Department at 708-246-1800, Ext. 126.

Inside this issue:

Water Treatment Process 2
Water Quality Test Results 2
Definitions 3
Contaminants that might be found in drinking 3
Water Treatment Chemicals 3
Where does my water come from? 4
Water Assessment Summary 4

VILLAGE OF WESTERN SPRINGS

ANNUAL WATER QUALITY REPORT

Continuing Our Commitment

The Village of Western Springs is required by the IEPA to provide an Annual Water Quality Report that covers all required testing and is designed to inform you about the quality of the drinking water. The report includes details about where your water comes from, how it is processed, and what the finished water contains.

Throughout the 2017 calendar year, the Village of Western Springs complied with all primary EPA water regulations. As in the past, the Village is committed to delivering a quality drinking water.

The Village of Western Springs Board of Trustees is the governing body that oversees the Water Treatment Plant and the Water Distribution System. The Board meets on the second and fourth Mondays of each month. The Infrastructure Commission, an advisory group of citizens, meets on an as-needed basis to discuss various topics related to the Village's water.

For more information about this report, or for any questions related to your drinking water, please contact Erin Duffy, the Water Treatment Plant Superintendent, at eduffy@wsprings.com.

2017 - 2018 Water System Update

The Village of Western Springs Water Department worked diligently this year to comply with all state and federal EPA regulations This included the organization of a Lead and Copper Service Line Survey, which elicited a response from nearly sixty percent of the community. The department will be working diligently to complete the survey prior to January 2019. If you have not done so already, please visit **www.wsprings.com/leadandcopper** and complete the survey.

In an effort to become more transparent in the age of information, the Water Department has spent a significant amount of time updating its web page over the past year. The web page now provides monthly water quality averages, lead in drinking water information, two FAQ sections, and flushing suggestions/instructions. If you have not done so already, check it out!

Municipal Services, as a whole, has utilized 2017 and a good portion of 2018, thus far, planning for future infrastructure improvements including new well construction in Field Park and the painting of the standpipe located behind Garden Market. While these projects are both still in the early phases of development, they will provide much needed improvements to the water system infrastructure. For more information on these capital improvement projects, look for the announcement of the 2017 Infrastructure Report in the coming months.

The Water Treatment Process

Beginning in 2013, The Village brought the retro-fitted Low Pressure Reverse Osmosis Water Treatment Plant online. Reverse Osmosis is a water purification technology that utilizes semipermeable membranes to limit the amount of contaminants in the drinking water. Reverse Osmosis can remove many types of ions and molecules from solutions, as well as, bacteria.

All the well water pumped to the Water Treatment Plant is filtered (pre-treatment) with a portion sent to the RO units and a portion blended (the blended portion is approx. 35% for Well 3 and 45 % for Well 4). Once blended, the water is chemically treated and sent to the Village's reservoir as the final product, which is then pumped into the Village's distribution system.

Water Quality Test Results*

Regulated Contaminants	Sample Location	Collection Date(s)	Highest Level Detected	Range of Levels Detected	Unit of Measurement	MCLG Drinking	USEPA MCL Drinking Primary	USEPA MCL Drinking Violation	Likely Source of Contamination
Disinfectant-monthly									
Chlorine	Distribution	12/31/2017	0.9	0.5-0.9	ppm	MRDLG=4	MRDL=4	No	A water additive to control microbes
DBP's (TTHM)-quarterly									
Total Trihalomethanes	Distribution	09/20/2017	7.43	0-7.43	ppb	No Goal for Total	80	No	By-product of disinfection
DBP's (HAA5)-quarterly									
Haloacetic acids	Distribution	09/20/2017	1.53	0-1.53	ppb	No Goal for Total	60	No	By-product of disinfection
Inorganics (IOC)- 3 years									
Barium	Finished– WTP	04/21/2015	0.00944	0.00944	ppm	2	2	No	Rock/soil erosion
Fluoride	Finished– WTP	04/21/2015	0.673	0.673	ppm	4	4	No	Rock/soil erosion
Iron	Finished– WTP	04/21/2015	0.076	0.076	ppm	1.0 (IL)		No	Rock/soil erosion
Sodium	Finished– WTP	04/21/2015	60.4	60.4	ppm			No	Rock/soil erosion
Inorganics (IOC)-3 years									
Arsenic	Well #1	10/13/2015	3.48	3.48	ppb	0.0	10	No	Rock/soil erosion
Barium	Well #1	10/13/2015	0.0255	0.0255	ppm	2.0	2.0	No	Rock/soil erosion
Fluoride	Well #1	10/13/2015	0.22	0.22	ppm	4.0	4.0	No	Rock/soil erosion
Iron	Well #1	10/13/2015	2.0	2.0	ppm		1.0 (IL)	No	Rock/soil erosion
Manganese	Well #1	10/13/2015	190	190	ppb	150.0	150(IL)	No	Rock/soil erosion
Sodium	Well #1	10/13/2015	119	119	ppm			No	Rock/soil erosion
Radionuclides-6 years									
Alpha Emitters	Well #1	10/18/2016	5.1	5.1	pCi/L		15.0	No	Rock/soil erosion
Combined Radium (226&228)	Well #1	10/18/2016	1.3	1.3	pCi/L		5.0	No	Rock/soil erosion
Combined Radium (226&228)	Finished– WTP	01/11/2017	3.8	3.8	pCi/L		5.0	No	Rock/soil erosion
Uranium	Finished– WTP	02/11/2015	0.0596	0.0596	ppb		30.0	No	Rock/soil erosion

***Table shows most recent data (2015-2017) from samples collected for the IEPA. Data updated as of 03/01/2018.**

AL—Action level
DBP's—Disinfection By Products
HAA—Haloacetic Acids
IL—Illinois
IOC—Inorganic Chemicals
MCL (Maximum Contaminant Level) The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
MCLG (Maximum Contaminant Level Goal) The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
MRDL (Maximum Residual Disinfectant Level) The highest level of disinfectant allowed in drinking water.
MRDLG (Maximum Residual Disinfectant Level Goal) The level of disinfectant in drinking water below which there is no known or expected risk to health.
ND—Not detected
pCi/L (picocuries per liter) A measure of radioactivity.
ppb (parts per billion) One part substance per billion parts water.
ppm (parts per million) One part substance per million parts water.
SOC—Synthetic Organic Chemicals
TTHM—Total Trihalomethanes
VOC—Volatile Organic Chemicals
WTP—Water Treatment Plant
90th%—90th percentile

*While your drinking water meets EPA standards for arsenic, it does contains low levels of arsenic. EPA's standard balances the current understanding of arsenics possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause can-

[1]There is not a state or federal MCL for sodium. Monitoring is required to provide information to consumers and health officials that are concerned about sodium intake due to dietary precautions. If you are on a sodium restricted diet, you should consult a physician about this level of sodium in the water.

Lead and Copper

Lead and Copper– 3 years	Sample Location	Collection Date	Unit of Measurement	MCLG Drinking	Action Level (AL)	90th Percentile	No. of Sites over AL	USEPA MCL Drinking Violation	Likely source of Contamination
Lead	Distribution	2017	ppb	0	15	2.71	1	No	Homeowners Plumbing
Copper	Distribution	2017	ppm	1.3	1.3	0.32	0	No	Homeowners Plumbing

Contaminants That Might Be Found in Drinking Water

Possible contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife;

Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming;

Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban storm water runoff and residential uses;

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems;

Radioactive contaminants, which may be naturally occurring or be the result of oil and gas production.

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk.

In order to ensure that tap water is safe to drink, USEPA prescribes regulations, which limit the amount of certain substances in the water provided by the public water system. Federal Drug Administration regulations establish limits for contaminants in bottled water.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested.

More information about contaminants and potential health effects can be obtained by calling the:

USEPA's Safe Drinking Water Hotline (800-426-4791) or visiting **www.epa.gov.**

More information is also available on the Village of Western Springs Water Department web page at http://www.wsprings.com/423/Water-Department.

Water Treatment Chemicals

Chemicals added to the water during 2017 include the following:

Chlorine (bleach) is added to the water for the purpose of disinfection. A free chlorine residual is used to inactivate pathogenic bacteria that may find their way into the distribution system and to help limit bacterial activity in the water. By taking chlorine residuals, the amount of this disinfecting agent is determined. Finished water leaving the plant carries a chlorine residual of approximately 1.0 ppm. As the water travels through the distribution system the residual dissipates and at the furthest end of the system it drops to approximately 0.2 ppm.

Caustic (sodium hydroxide) is used to raise the final pH of the finished water.

Corrosion Inhibitor The corrosion inhibitor utilized by the Village is an orthophosphate/polyphosphate blend. It is used to lay down a thin, protective film in the water main to control corrosion, as well as, a sequestering agent for low to moderate levels of iron.

Antiscalant is used as a low pH conditioner to prevent premature fouling of the membranes.

ANNUAL WATER QUALITY REPORT / CONSUMER CONFIDENCE REPORT 2016

VILLAGE OF WESTERN SPRINGS

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Where Does My Water Come From?

Since the development of the Western Springs' water system in 1882, the Village has obtained its water from ground water sources. During the early years these included springs from which the community derives its name. In subsequent years, the Village became dependent upon well water and since the late 1950's, the primary water source has been deep wells.

At the present time, the Village has three wells, two deep and one shallow. Of the two deep wells, one draws water from the Galesville aquifer and the other draws water from both Galesville and Mt. Simon aquifers. These aquifers are underground rivers passing through sandstone formations which extend north into Wisconsin. The shallow well draws water from the Niagaran aquifer, an underground river that passes through a limestone formation.

Source Water Assessment Summary

The Source Water Assessment has been completed and the Illinois EPA has determined that "Western Springs' wells #3 and #4 source water is not susceptible to contamination. This determination is based on a number of criteria including: monitoring conducted at the wells, monitoring conducted at the entry point to the distribution system, and the available hydro-geological data on the well."

To view a summary version of the completed Source Water Assessment, including: Importance of Source Water; Susceptibility to Contamination Determination; and documentation/recommendation of Source Water Protection Efforts, you may access the Illinois EPA web site at **www.epa.state.il.us/cgi-bin/wp/swap-fact-sheets.pl**.

Use of Outdoor Water

This summer enjoy the use of water for outdoor purposes without any restrictions; however, please practice conservancy.

Water Bill Payment Made Easy

Automatic payment of your water bill is available to all residents. Your payment is electronically withdrawn from the account of your choice on the due date of your water bill.

Interested? The application is available at www.wsprings.com or the Village Hall.

For more information, please contact the Finance Department at 708-246-1800, Ext. 126.

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Water Treatment Process 2
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VILLAGE OF WESTERN SPRINGS

ANNUAL WATER QUALITY REPORT

Continuing Our Commitment

The Village of Western Springs is required by the IEPA to provide an Annual Water Quality Report that covers all required testing and is designed to inform you about the quality of the drinking water. The report includes details about where your water comes from, how it is processed, and what the finished water contains.

Throughout the 2016 calendar year, the Village of Western Springs complied with all primary EPA water regulations. As in the past, the Village is committed to delivering a good quality drinking water.

The Village of Western Springs Board of Trustees is the governing body that oversees the Water Treatment Plant and the Water Distribution System. The Board meets on the second and fourth Mondays of each month. The Infrastructure Commission, an advisory group of citizens, meets on an as-needed basis to discuss various topics related to the Village's water.

For more information about this report, or for any questions related to your drinking water, please contact Erin Duffy, the Water Treatment Plant Superintendent, at eduffy@wsprings.com.

2016 - 2017 Water System Update

In 2016 the Village experienced 46 water main breaks at various locations throughout the Village. This was down from 49 main breaks in 2015.

In May the Village will be publishing, on the Village's website, the third annual Water Infrastructure Report. Please feel free to browse the report at your leisure as it outlines annual data on the Village's water infrastructure including unaccounted for water information and water main break locations for the previous calendar year.

Additional items outlined in the Water Infrastructure Report include major capital projects that were completed in 2016. These capital projects include automation of the Water Treatment Plant, completion of a comprehensive leak detection survey, installation of an automated hydrant flusher in Ridgewood, and exploration of Well #1 treatment options in the event of an emergency.

The Water Infrastructure Report also identifies future capital projects which may include interior and exterior painting of the Village's standpipe and elevated tanks, continual monitoring of unaccounted for water loss, and rebuilding the reservoir roof, hatch, and ladder.

For more information on any of these projects please visit the Village website at http://www.wsprings.com to view the complete "2016 Water Infrastructure

The Water Treatment Process

Beginning in 2013, The Village brought the retro-fitted Low Pressure Reverse Osmosis Water Treatment Plant online. Reverse Osmosis is a water purification technology that utilizes semipermeable membranes to limit the amount of contaminants in the drinking water. Reverse Osmosis can remove many types of ions and molecules from solutions, as well as, bacteria.

All the well water pumped to the Water Treatment Plant is filtered (pre-treatment) with a portion sent to the RO units and a portion blended (the blended portion is approx. 35% for Well 3 and 45 % for Well 4). Once blended, the water is chemically treated and sent to the Village's reservoir as the final product, which is then pumped into the Village's distribution system.

Throughout the 2016 calendar year, the Village of Western Springs complied with all primary EPA water regulations. As in the past, the Village is committed to delivering a good quality drinking water.

Water quality can vary throughout the course of the year based on operational considerations, seasonal demands, and system repairs.

Coliform Bacteria

Highest No. of Positive	Total No. of Positive E.Coli/Fecal Coliform Samples	MCLG Drinking	Total Coliform MCL	Fecal Coliform/ E.Coli MCL	USEPA MCL Drinking Violation	Likely Source of Contamination
2	0	0	1 positive monthly sample	0	No	Naturally present in environment

AL—Action level
DBP's—Disinfection By Products
HAA—Haloacetic Acids
IL—Illinois
IOC—Inorganic Chemicals
MCL (Maximum Contaminant Level) The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
MCLG (Maximum Contaminant Level Goal) The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
MRDL (Maximum Residual Disinfectant Level) The highest level of disinfectant allowed in drinking water.
MRDLG (Maximum Residual Disinfectant Level Goal) The level of disinfectant in drinking water below which there is no known or expected risk to health.
ND—Not detected
pCi/L (picocuries per liter) A measure of radioactivity.
ppb (parts per billion) One part substance per billion parts water.
ppm (parts per million) One part substance per million parts water.
SOC—Synthetic Organic Chemicals
TTHM—Total Trihalomethanes
VOC—Volatile Organic Chemicals
WTP—Water Treatment Plant
90th%—90th percentile

Water Quality Test Results*

Regulated Contaminants	Sample Location	Collection Date(s)	Highest Level Detected	Range of Levels Detected	Unit of Measurement	MCLG Drinking	USEPA MCL Drinking Primary	USEPA MCL Drinking Violation	Likely Source of Contamination
Disinfectant-monthly									
Chlorine	Distribution	12/31/2016	0.9	0.5-0.9	ppm	MRDLG=4	MRDL=4	No	A water additive to control microbes
DBP's (TTHM)-quarterly									
Total Trihalomethanes	Distribution	9/20/2016	11.20	0-11.20	ppb	No Goal for Total	80	No	By-product of disinfection
DBP's (HAA5)-quarterly									
Haloacetic acids	Distribution	9/20/2016	1.0	0-1.0	ppb	No Goal for Total= 1.44	60	No	By-product of disinfection
Inorganics (IOC)- 3 years									
Barium	Finished– WTP	4/21/2015	0.00944	0.00944	ppm	2	2	No	Rock/soil erosion
Fluoride	Finished– WTP	4/21/2015	0.673	0.673	ppm	4	4	No	Rock/soil erosion
Iron	Finished– WTP	4/21/2015	0.076	0.076	ppm	1.0 (IL)		No	Rock/soil erosion
Sodium	Finished– WTP	4/21/2015	60.4	60.4	ppm			No	Rock/soil erosion
Inorganics (IOC)-3 years									
Arsenic	Well #1	10/13/2015	3.48	3.48	ppb	0.0	10	No	Rock/soil erosion
Barium	Well #1	10/13/2015	0.0255	0.0255	ppm	2.0	2.0	No	Rock/soil erosion
Fluoride	Well #1	10/13/2015	0.22	0.22	ppm	4.0	4.0	No	Rock/soil erosion
Iron	Well #1	10/13/2015	2.0	2.0	ppm		1.0 (IL)	No	Rock/soil erosion
Manganese	Well #1	10/13/2015	190	190	ppb	150.0	150(IL)	No	Rock/soil erosion
Sodium	Well #1	10/13/2015	119	119	ppm			No	Rock/soil erosion
Radionuclides-6 years									
Alpha Emitters	Well #1	10/18/2016	5.1	5.1	pCi/L		15.0	No	Rock/soil erosion
Combined Radium (226&228)	Well #1	10/18/2016	1.3	1.3	pCi/L		5.0	No	Rock/soil erosion
Combined Radium (226&228)	Finished– WTP	11/26/2016	4.4	4.4	pCi/L		5.0	No	Rock/soil erosion
Uranium	Finished– WTP	02/11/2015	0.0596	0.0596	ppb		30.0	No	Rock/soil erosion

Lead and Copper

Lead and Copper– 3 years	Sample Location	Collection Date	Unit of Measurement	MCLG Drinking	Action Level (AL)	90th Percentile	No. of Sites over AL	USEPA MCL Drinking Violation	Likely source of Contamination
Lead	Distribution	2014	ppb	0	15	6.02	2	No	Homeowners Plumbing
Copper	Distribution	2014	ppm	1.3	1.3	0.1391	0	No	Homeowners Plumbing

***Table shows most recent data (2014-2016) from samples collected for the IEPA. Data updated as of 04/01/2017.**

Contaminants That Might Be Found in Drinking Water

Possible contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, and wildlife;

Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial, or domestic wastewater discharges, oil and gas production;

Pesticides and herbicides, may come from a variety of sources such as urban storm water runoff and residential uses;

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems;

Radioactive contaminants, which may be naturally occurring or be the result of oil and gas production.

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. In order to ensure that tap water is safe to drink, USEPA prescribes regulations, which limit the amount of certain substances in the water provided by the public water system. Federal Drug Administration regulations establish limits for contaminants in bottled water.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline.

If present, elevated levels of lead can cause serious health problems. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested.

More information about contaminants and potential health effects can be obtained by calling the **USEPA's Safe Drinking Water Hotline (800-426-4791)** or visiting **www.epa.gov.**

Water Treatment Chemicals

Chemicals added to the water during 2016 include the following:

Chlorine (bleach) is added to the water for the purpose of disinfection. A free chlorine residual is used to inactivate pathogenic bacteria that may find their way into the distribution system and to help limit bacterial activity in the water. By taking chlorine residuals, the amount of this disinfecting agent is determined. Finished water leaving the plant carries a chlorine residual of approximately 1.0 ppm. As the water travels through the distribution system the residual dissipates and at the furthest end of the system it drops to approximately 0.2 ppm.

Caustic (sodium hydroxide) is used to raise the final pH of the finished water.

Corrosion Inhibitor The corrosion inhibitor utilized by the Village is an orthophosphate/polyphosphate blend. It is used to lay down a thin, protective film in the water main to control corrosion, as well as, a sequestering agent for low to moderate levels of iron.

Antiscalant is used as a low pH conditioner to prevent premature fouling of the membranes.

ANNUAL WATER QUALITY REPORT / CONSUMER CONFIDENCE REPORT 2015

VILLAGE OF WESTERN SPRINGS

ANNUAL WATER QUALITY REPORT

Water testing performed in 2015

Water Bill Payment Made Easy

Automatic payment of your water bill is available to all residents. Your payment is electronically withdrawn from the account of your choice on the due date of your water bill.

Interested? The application is available at www.wsprings.com or the Village Hall.

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Continuing Our Commitment

The Village of Western Springs is required to provide an Annual Water Quality Report that covers all required testing and is designed to inform you about the quality of the drinking water. The report includes details about where your water comes from, how it is processed, and what the finished water contains.

Throughout the 2015 calendar year, the Village of Western Springs complied with all primary EPA water regulations. As in the past, the Village is committed to delivering a good quality drinking water.

The Village of Western Springs Board of Trustees is the governing body that oversees the Water Treatment Plant and the Water Distribution System. The Board meets on the second and fourth Mondays of each month. The Infrastructure Commission, an advisory group of citizens, meets on an as-needed basis to discuss various topics related to the Village's water.

For more information about this report, or for any questions related to your drinking water, please contact Ken Hayes at khayes@wsprings.com or Erin Duffy at eduffy@wsprings.com.

2015 - 2016 Water System Update

In 2015 the Village experienced 49 water main breaks at various locations throughout the Village. This was down from 71 main breaks in 2014 and 111 in 2013.

In February of 2016 the Village published, on the Village's website, the second annual Water Infrastructure Report. Please feel free to browse the report at your leisure as it outlines annual data on the Village's water infrastructure including unaccounted for water information and water main break locations for the previous calendar year.

Additional items outlined in the Water Infrastructure Report include major capital projects that were completed in 2015. These capital projects include the reconditioning of well #3, lining of the transmission pipe for well #1 underneath the BNSF railroad tracks, and the Ice Pigging (cleaning) of the distribution main in the Ridgewood subdivision.

The Water Infrastructure Report also identifies future capital projects which may include interior and exterior painting of the Village's standpipe and elevated tanks, construction of a new deep well, and water main lining and replacement programs.

For more information on any of these projects please visit the Village website at http://www.wsprings.com to view the complete "2015 Water Infrastructure Report".

The Water Treatment Process

Beginning in 2013, The Village brought the retro-fitted Low Pressure Reverse Osmosis Water Treatment Plant online. Reverse Osmosis is a water purification technology that utilizes semipermeable membranes to limit the amount of contaminants in the drinking water. Reverse Osmosis can remove many types of ions and molecules from solutions, as well as bacteria.

All the well water pumped to the Water Treatment Plant is filtered (pre-treatment) with a portion sent to the RO units and a portion blended (the blended portion is approx. 35% for Well 3 and 45 % for Well 4). Once blended, the water is chemically treated and sent to the Village's reservoir as the final product, which is then pumped into the Village's distribution system.

Throughout the 2015 calendar year, the Village of Western Springs complied with all primary EPA water regulations. As in the past, the Village is committed to delivering a good quality drinking water.

Water quality can vary throughout the course of the year based on operational considerations, seasonal demands, and system repairs.

Where Does My Water Come From?

Since the development of the Western Springs' water system in 1882, the Village has obtained its water from ground water sources. During the early years these included springs from which the community derives its name. In subsequent years, the Village became dependent upon well water and since the late 1950's, the primary water source has been deep wells.

At the present time, the Village has three wells, two deep and one shallow. Of the two deep wells, one draws water from the Galesville aquifer and the other draws water from both Galesville and Mt. Simon aquifers. These aquifers are underground rivers passing through sandstone formations which extend north into Wisconsin. The shallow well draws water from the Niagaran aquifer, an underground river that passes through a limestone formation.

Water Quality Test Results*

Regulated Contaminants	Sample Location	Collection Date(s)	Highest Level Detected	Range of Levels Detected	Unit of Measurement	MCLG Drinking	USEPA MCL Drinking Primary	USEPA MCL Drinking Violation	Likely Source of Contamination
Disinfectant-monthly									
Chlorine	Distribution	12/31/2015	0.9	0.4-0.9	ppm	MRDLG=4	MRDL=4	No	A water additive to control microbes
Nitrates & Nitrites yearly									
Nitrate/ Nitrite (N03-N)	Finished– WTP	07/24/2015	ND	ND	ppm		10.0	No	Release from fertilizer
DBP's (TTHM)-quarterly									
Total Trihalomethanes	Distribution	2015	3.30	1.22-3.30	ppb	No Goal for Total	80	No	Chlorine+organics
DBP's (HAA5)-quarterly									
Total Haloacetic acids	Distribution	2015	ND	ND	ppb	No Goal for Total	60	No	Chlorine+organics
Inorganics (IOC)- 3 years									
Barium	Finished– WTP	4/21/2015	0.00944	0.00944	ppm	2	2	No	Rock/soil erosion
Fluoride	Finished– WTP	4/21/2015	0.673	0.673	ppm	4	4	No	Rock/soil erosion
Iron	Finished– WTP	4/21/2015	0.076	0.076	ppm	1.0 (IL)		No	Rock/soil erosion
Sodium	Finished– WTP	4/21/2015	60.4	60.4	ppm			No	Rock/soil erosion
Inorganics (IOC)-3 years									
Arsenic	Well #1	10/13/2015	3.48	3.48	ppb	0.0	10	No	Rock/soil erosion
Barium	Well #1	10/13/2015	0.0255	0.0255	ppm	2.0	2.0	No	Rock/soil erosion
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Manganese	Well #1	10/13/2015	190	190	ppb	150.0	150(IL)	No	Rock/soil erosion
Sodium	Well #1	10/13/2015	119	119	ppm			No	Rock/soil erosion
Lead & Copper-3 years						MCLG	AL	90% Over AL	
Copper	Distribution	2014			ppm	1.3	1.3	0.1391 0 No	Homeowners plumbing
Lead	Distribution	2014			ppb	0	15	6.02 2 No	Homeowners plumbing
Organics(VOC)-3 years	Finished– WTP	2/11/2015	ND	ND	ppb			No	Manmade compounds
Organics(SOC)-3 years	Finished– WTP	2/11/2015	ND	ND	ppb			No	Manmade compounds
Organics(SOC)-3 years	Finished– WTP	5/27/2015	ND	ND	ppb			No	Manmade compounds
Radionuclides-6 years									
Alpha Emitters	Finished– WTP	2/11/2015	7.80	7.80	pCi/L		15.0	No	Rock/soil erosion
Combined Radium (226&228)	Finished– WTP	2/11/2015	4.5	4.5	pCi/L		5.0	No	Rock/soil erosion
Uranium	Finished– WTP	2/11/2015	0.0596	0.0596	ppb		20.0	No	Rock/soil erosion

***Table shows most recent data (2014-2015) from samples collected for the IEPA. Data updated as of 05/02/2016.**

TABLE DEFINITIONS

AL—Action level
DBP's—Disinfection By Products
HAA—Haloacetic Acids
IL—Illinois
IOC—Inorganic Chemicals
MCL (Maximum Contaminant Level) The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
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pCi/L (picocuries per liter) A measure of radioactivity.
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SOC—Synthetic Organic Chemicals
TTHM—Total Trihalomethanes
VOC—Volatile Organic Chemicals
WTP—Water Treatment Plant
90th%—90th percentile

Contaminants That Might Be Found in Drinking Water

Possible contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, and wildlife;

Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial, or domestic wastewater discharges, oil and gas production;

Pesticides and herbicides, may come from a variety of sources such as urban storm water runoff and residential uses;

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems;

Radioactive contaminants, which may be naturally occurring or be the result of oil and gas production.

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. In order to ensure that tap water is safe to drink, USEPA prescribes regulations, which limit the amount of certain substances in the water provided by the public water system. Federal Drug Administration regulations establish limits for contaminants in bottled water.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline.

If present, elevated levels of lead can cause serious health problems. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested.

More information about contaminants and potential health effects can be obtained by calling the **USEPA's Safe Drinking Water Hotline (800-426-4791)** or visiting **www.epa.gov.**

Water Treatment Chemicals

Chemicals added to the water during 2015 include the following:

Chlorine (bleach) is added to the water for the purpose of disinfection. A free chlorine residual is used to inactivate pathogenic bacteria that may find their way into the distribution system and to help limit bacterial activity in the water. By taking chlorine residuals, the amount of this disinfecting agent is determined. Finished water leaving the plant carries a chlorine residual of approximately 1.0 ppm. As the water travels through the distribution system the residual dissipates and at the furthest end of the system it drops to approximately 0.2 ppm.

Caustic (sodium hydroxide) is used to raise the final pH of the finished water.

Corrosion Inhibitor The corrosion inhibitor utilized by the Village is an orthophosphate/polyphosphate blend. It is used to lay down a thin, protective film in the water main to control corrosion, as well as, a sequestering agent for low to moderate levels of iron.

Antiscalant is used as a low pH conditioner to prevent premature fouling of the membranes.

VILLAGE OF
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Source Water Assessment Summary

The Source Water Assessment has been completed and the Illinois EPA has determined that "Western Springs' wells #3 and #4 source water is not susceptible to contamination. This determination is based on a number of criteria including: monitoring conducted at the wells, monitoring conducted at the entry point to the distribution system, and the available hydro-geological data on the well."

To view a summary version of the completed Source Water Assessment, including: Importance of Source Water; Susceptibility to Contamination Determination; and documentation/recommendation of Source Water Protection Efforts, you may access the Illinois EPA web site at **www.epa.state.il.us/cgi-bin/wp/swap-fact-sheets.pl**.

Use of Outdoor Water

This summer enjoy the use of water for outdoor purposes without any restrictions; however, please practice conservancy.

WELL NOS 3 AND 4 INTERFERENCE TEST REPORT

BAXTER & WOODMAN
Consulting Engineers
8678 Ridgefield Road, Crystal Lake, IL 60012 • 815.459.1260 • baxterwoodman.com

January 25, 2018

Mr. Matthew Supert
Director of Municipal Services
Village of Western Springs
740 Hillgrove Avenue
Western Springs, Illinois 60558

Subject: Village of Western Springs – Well Nos. 3 and 4 Interference Test

Dear Mr. Supert:

The Village intends to construct a new deep aquifer water supply well to supplement Water Supply Well Nos. 3 and 4, used as the primary water sources. The two existing wells are both finished in the Ironton-Galesville sandstone, which is the same aquifer from which the new Well No. 5 is expected to draw water. The Village's third well, Well No. 1, is a shallow aquifer well that is only used for emergency purposes. When Well No. 5 is completed, Well No. 1 will be abandoned because the wellhead is below grade, has poor water quality, and is located within the railroad right-of-way.

The Village evaluated eight locations for Well No. 5. The locations were evaluated based on whether the site was Village-owned, distance to existing wells, distance to water treatment plant, distance to residences, target aquifer, length of transmission main, and estimated cost. Of the eight locations, the Village Infrastructure Commission recommended that Well No. 5 be drilled at Field Park as shown in Exhibit A. This site has the advantage that it is partially Village owned and far from Well No. 4. It is also close to the water treatment plant and would have a short transmission main. Although this location is 4,900 feet from Well No. 4, it is only 1,200 feet from Well No. 3. Ideally, deep aquifer wells should be located at least one-half mile apart (2,640 feet). The purpose of this investigation is to estimate the potential impact on the water levels in Well Nos. 3 and 4 due to operating the new well at the proposed location.

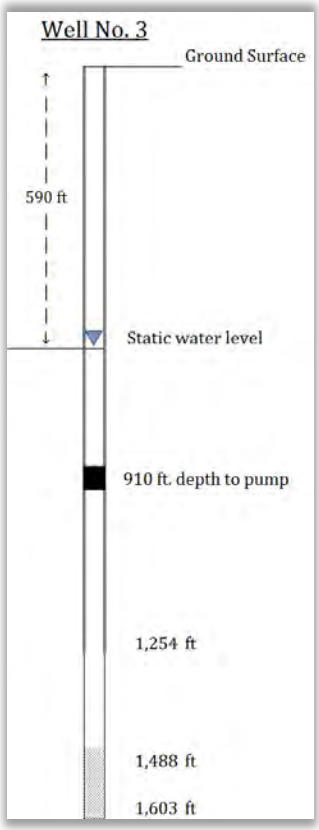

Figure 1 - Diagram of Well No. 3

Background

Well No. 3 Details (shown in Figure 1):

- This well was drilled in 1955 to a reported depth of 1,603 ft. and draws water from the Ironton-Galesville sandstone formation.
- Over time, the bottom of the well has filled in with sand, and the last reported depth was 1,488 ft.
- The well is cased with an 18-inch diameter pipe down to 1,254 ft.

- The current pumping rate is approximately 1,130 +/- gallons per minute (gpm).
- At the time of this investigation, the static water level was approximately 590 ft.
- The pump is set at a depth of 910 ft.

Well No. 4 Details (shown in Figure 2):

- This well was drilled in 1966 to a reported depth of 1,913 ft. and drew water from both the Ironton-Galesville and Mt. Simon sandstone formations.
- In 1991, the bottom of the well was filled in up to 1,482 ft. to block off the Mt. Simon formation, leaving it open to only the Ironton-Galesville formation.
- The well is cased down to 1,222 ft.
- The current pumping rate is approximately 1,110 +/- gpm.
- At the time of this investigation, the static water level was approximately 565 ft.
- The pump is set at a depth of 769 ft.

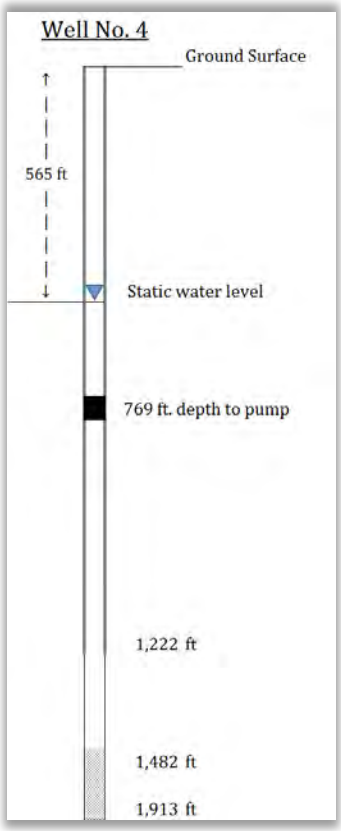

Figure 2 - Diagram of Well No. 4

Interference Test

When water is pumped from a well, the initial discharge is derived from casing and aquifer storage immediately surrounding the well. This creates a cone of depression as shown in Figure 3. As pumping continues, more water must be derived from the aquifer at greater distances from the well. This means that the cone of depression must expand. The radius of influence of the well, defined as the radial distance from a pumping well where drawdown is effectively zero for a given time, increases as the cone expands.

An interference test involves pumping a well while simultaneously monitoring the water levels in other wells of interest (observation wells) in addition to the pumped well. Before performing an interference test, all wells to be monitored are turned off for a sufficient amount of time to obtain a representative non-pumping (static) level. The pumped well is then run at a constant rate for a minimum of 24 hours. The resulting data allows for the determination of the radius of influence.

The radius of influence becomes important when estimating the amount of additional drawdown in a second well located within the radius of influence, as shown in Figure 4. For example, if at a certain distance from a pumped well (Well A), the drawdown in the aquifer is 20 feet, then a new well (Well B) located at that point will have an additional 20 feet of drawdown when the two are operated together. This impact also applies in the reverse direction. When the two wells are pumped at the same time, an additional 20 feet of drawdown will be observed in Well A. If the interference will lower the pumping level in Well A to a point below the depth of the pump, Well B should be located farther away or, if possible, pump in Well A should be lowered.

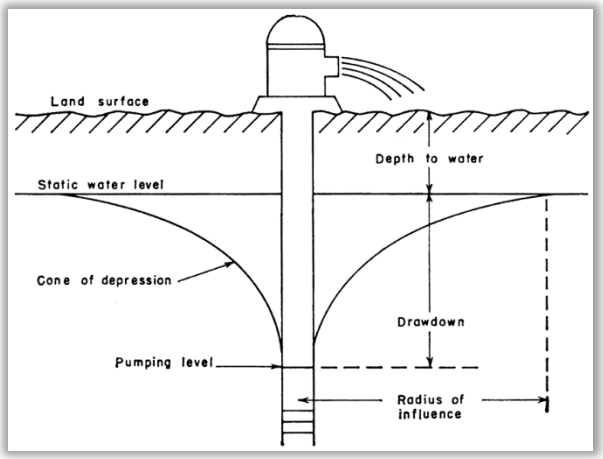

Figure 3 - Diagrammatic section of a pumping well showing drawdown, cone of depression, and radius of influence. Source: Kansas Geological Survey Bulletin 176

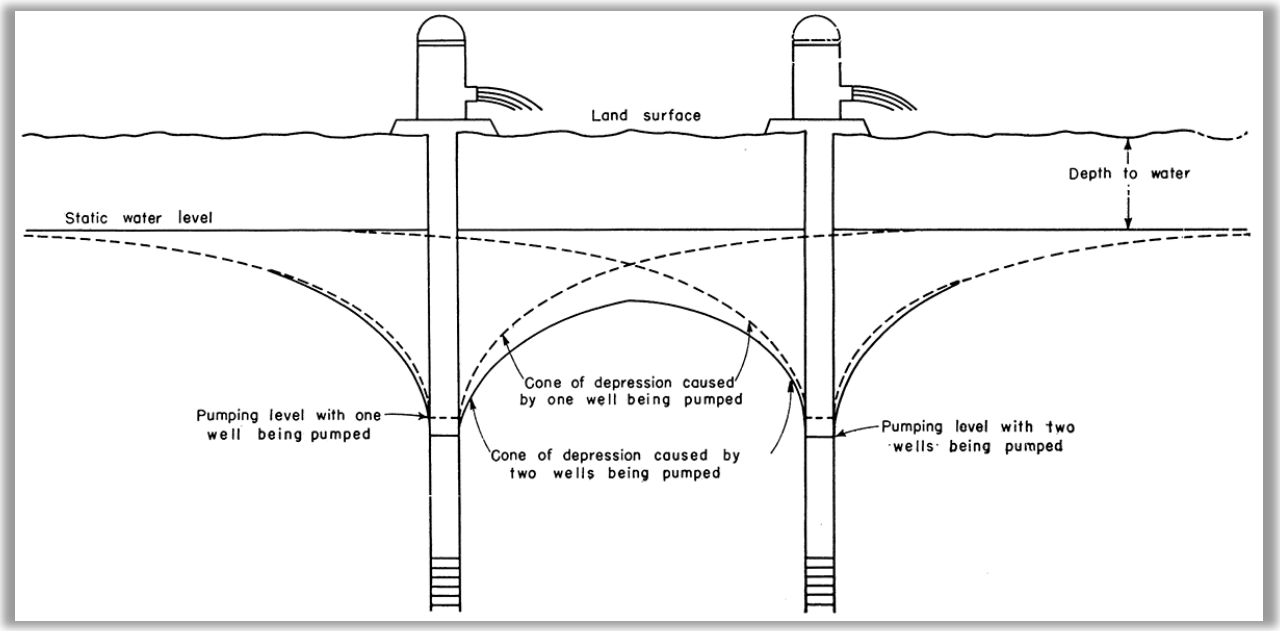

Figure 4 - Diagrammatic section of two closely spaced pumping wells showing mutual interference between wells and the resulting cones of depression. Source: Kansas Geological Survey Bulletin 176.

Testing Results – Well No. 3 Radius of Influence

Well No. 3 was pumped between December 4 and 5, 2017. An electronic drop line was used to measure the water levels in Well Nos. 3 and 4. Both wells were turned off approximately nine hours before the beginning of the test. Well No. 3 was operated for 24 hours while Well No. 4 was deactivated. The radius of influence was calculated by plotting the data on semilogarithmic graph paper as shown in Figure 5. The bottom axis represents the distance from Well No. 3. The vertical axis shows the drawdown, which is the distance the water level is lowered due to pumping. For a confined aquifer such as the Ironton-Galesville sandstone, the data points of the cone of depression will fall on a straight line on a semi-log graph. The line can be extrapolated until it reaches zero drawdown (top of the graph). As the figure shows, the straight line intersects the zero drawdown line at approximately 4,000 feet from Well No. 3. Below is a summary of testing results. All measurements represent the distance below the ground surface.

Well No. 3 pump setting	910 feet
Well No. 3 static water level	590.6 feet
Pumping rate	1,130 gpm
Pumping level after 24 hours	628.5 feet
Drawdown	37.9 feet
Height of water over the pump	281.5 ft.
Specific capacity (gpm/ft. drawdown)	29.82
Well No. 4 static water level	566.1 feet
Water level after 24 hours	565.5 feet
Drawdown	0.6 feet
Distance between Well Nos. 3 and 4	3,700 feet
Radius of influence of Well No. 3	4,000 feet
Interference at Well No. 5 location	**6 feet**

Testing Results – Well No. 4 Radius of Influence

Well No. 4 was pumped between December 7 and 8, 2017. An electronic drop line was used to measure the water levels in Well Nos. 3 and 4. Both wells were turned off approximately nine hours before the beginning of the test. Well No. 4 was operated for 24 hours while Well No. 3 was deactivated. The radius of influence was calculated by plotting the data on semilogarithmic graph paper as shown in Figure 6. Below is a summary of testing results. All measurements represent the distance below the ground surface.

Well No. 4 pump setting	769 feet
Well No. 4 static water level	565.0 feet
Pumping rate	1,110 gpm
Pumping level after 24 hours	659.5 feet
Drawdown	94.5 feet
Height of water over the pump	109.5 feet
Specific capacity (gpm/ft. drawdown)	11.75
Well No. 3 static water level	591.4 feet
Water level after 24 hours	591.0 feet
Drawdown	0.4 feet
Distance between Well Nos. 3 and 4	3,700 feet
Radius of influence of Well No. 4	4,000 feet
Interference at Well No. 5 location	**0 feet**

Conclusions

Well No. 5 is anticipated to be constructed similarly to Well No. 3, with the same capacity, drilling depth, and casing depth. The data shows that when Well No. 3 is operating, and Well No. 5 is pumped at its anticipated rate of 1,200 gpm, the impact at each well would only be an additional six feet of drawdown. Since approximately 281.5 feet of water remains over the pump after an extended pumping period, there should be no concerns about operating the two wells at the same time. Similarly, the data shows that there will be no impact on the water levels when Well Nos. 4 and 5 are operated at the same time.

Therefore, we believe a new Ironton-Galesville aquifer well located at the Field Park site will provide the Village with another reliable water source with minimal impact on Well Nos. 3 and 4. Please let me know if you have any questions.

Sincerely,

BAXTER & WOODMAN, INC.
CONSULTING ENGINEERS

Eric J. Murauskas, P.E.
EJM:py

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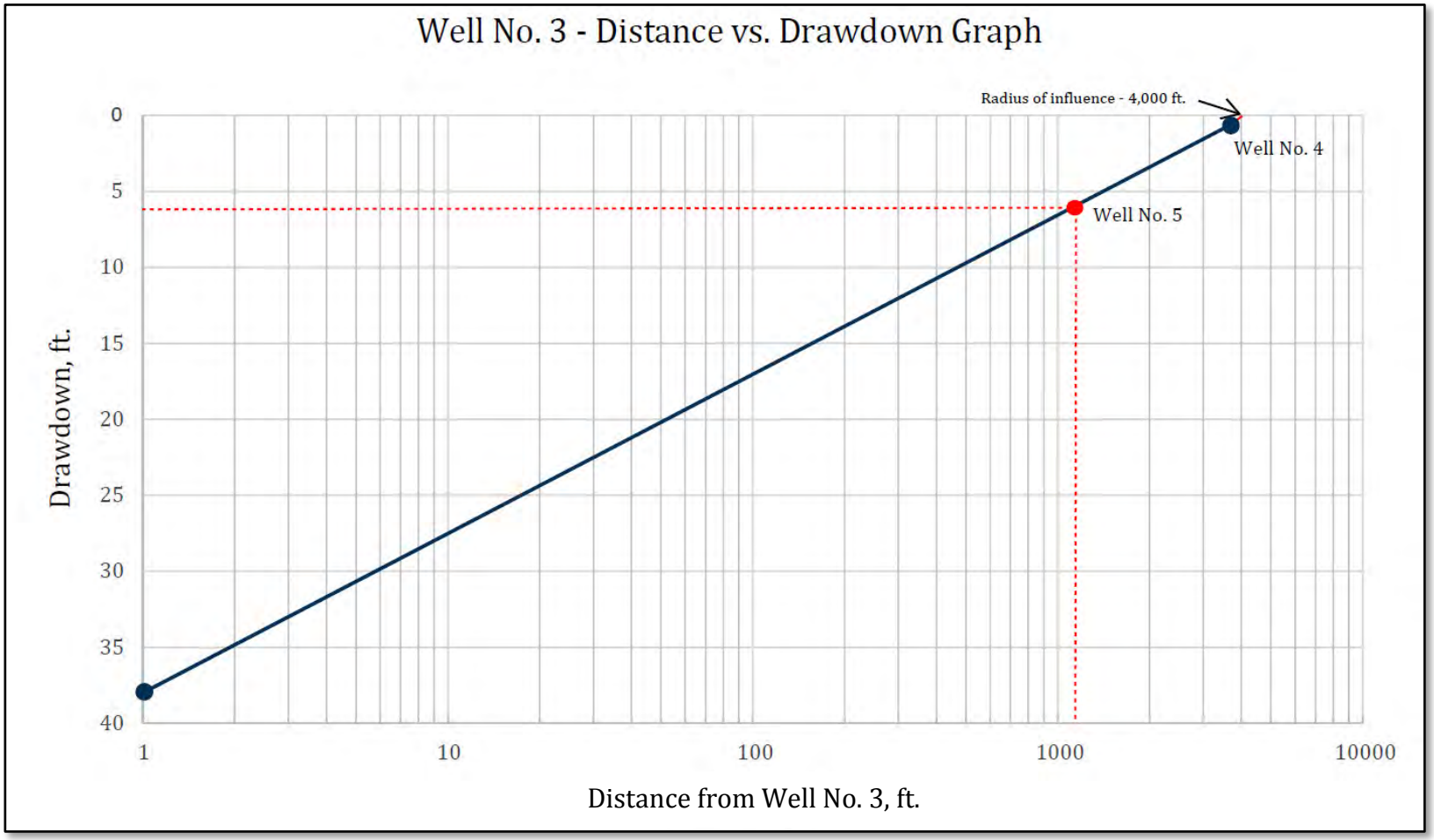
FIGURE 5



BAXTER & WOODMAN
Consulting Engineers

FIGURE 6

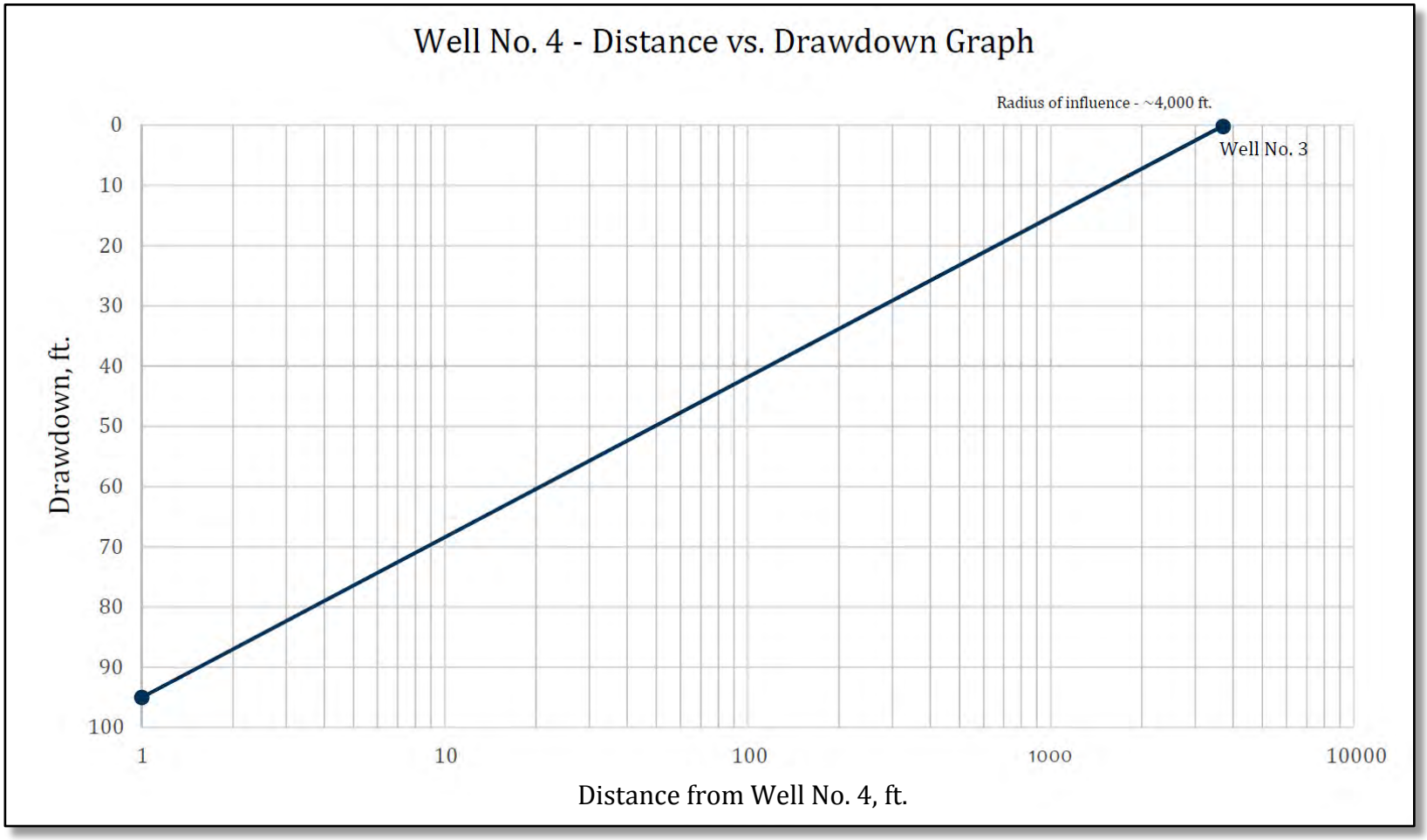
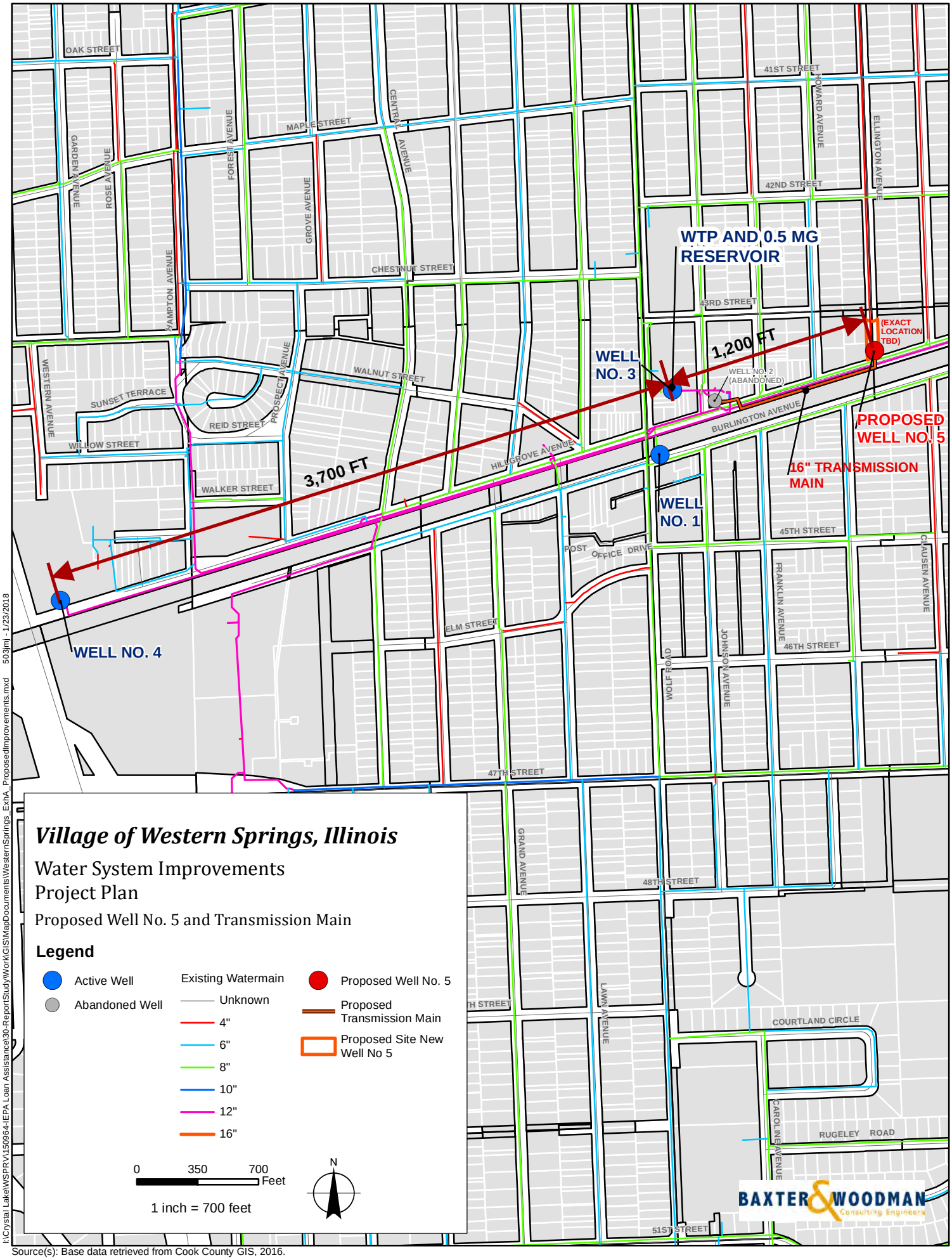

Well No. 4 - Distance vs. Drawdown Graph
Radius of influence - ~4,000 ft.
Well No. 3
Drawdown, ft.
0
10
20
30
40
50
60
70
80
90
100
1
10
100
1000
10000
Distance from Well No. 4, ft.

EXHIBIT A



Village of Western Springs, Illinois

Water System Improvements
Project Plan

Proposed Well No. 5 and Transmission Main

Legend

- Active Well
- Abandoned Well
- Existing Watermain
  - Unknown
  - 4"
  - 6"
  - 8"
  - 10"
  - 12"
  - 16"
- Proposed Well No. 5
- Proposed Transmission Main
- Proposed Site New Well No 5

0 350 700 Feet

1 inch = 700 feet

N

I:\Crystal Lake\WSPRV\150964-IEPA Loan Assistance\30-ReportStudyWork\GIS\MapDocuments\WesternSprings_ExhA_ProposedImprovements.mxd 503jmj - 1/23/2018

Source(s): Base data retrieved from Cook County GIS, 2016.

WATER STUDY REPORT, 2008

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Preface – Water Study Report

The Water Study Report (WSR) provides information to the reader about the choices before the Village Board of Western Springs in regard to the future source and treatment for potable water. The report has been prepared by the Water Study Group (WSG) with the assistance of the Finance Committee, the Ad-Hoc Water Group and engineering consultants, and has been reviewed by the Village's Infrastructure Commission and Public Works & Water Committee, both of which have invited comments from village residents. See Appendix 7 for the membership of these bodies.

The preparation of WSR was prompted by the recognition that a substantial financial expenditure was needed to continue the current water production system (WPS) using deep aquifers and lime-softening treatment. The 1998 report of the Ad-Hoc Group proposed improvements to the WPS that included replacement of components that were reaching the end of their design lives and the addition of other components that would improve the operation of the system and the quality of the finished water. The costs of these improvements were estimated at that time to be about $1.2M. Later, additional improvements were recommended that raised the estimated cost to about $2.5M or $3.0M. The Village applied to the Illinois EPA (IEPA) to finance a large portion of the improvements, but so far the loan has not been approved due to higher priority projects within the state. In the course of the subsequent nine years, key WPS components have come ever closer to the end of their useful lives. Also other water production options became worthwhile investigating. In late 2005 the Village decided that it should wait no longer for the IEPA loan approval and should conduct a comprehensive study of the possible sources of water, either the current deep aquifers or Lake Michigan, and of processes for treating aquifer water, if it were selected as the source.

The Village had investigated on several occasions the possibility of changing from deep aquifers to Lake Michigan as its source. These investigations had been rather cursory both because the capital cost of connecting to a nearby supplier of lake water was clearly higher than the capital cost of improving the existing system, and because the operational cost of buying lake water from a supplier was higher than the cost of producing water from the deep aquifers. Presently the capital costs are not obviously in favor of the current WPS.

The costs of alternate treatment processes, such as reverse osmosis and ion exchange, are much lower now than during the previous 1998 WPS study. This study evaluates these processes, as well as the lime-softening one, in its assessment of the deep aquifer option.

Other considerations favor another examination of the choice of the water source, such as effects of hardness and the long term availability of deep aquifer water. These issues, along with other issues associated with lake and deep aquifer water are assessed in the report, but the main reason for preparing the WSR now was the need for large near-term expenditure to assure the residents of a reliable, high quality supply of water.

The ten chapters of the report present (1) background information on the WPS, (2) multiple designs of the WPS, three with deep aquifer water and another with lake water as its source, (3) the estimated costs of each design, (4) the predicted performance of the water distribution with each design, (5) quantifiable benefits/drawbacks of each design, (6) non-quantifiable or intangible benefits/drawbacks of each design, (7) construction schedules for each design, (8)

financing of each design, (9) Infrastructure Commission's review of the WSR and comments received from residents and (10) Public Works & Water Committee's review of the WSR.

Most chapters are summaries of the information obtained on the particular topic, and the detailed information is found in the appendices referenced in the chapters. Eight appendices follow the ten chapters in the main body of the WSR.

Note that a version of the WSR will be submitted to the Village Board without a recommendation to approve it. If requested by the Board, the WSG would ask for the recommendation of the Committee and/or Commission.

Chapter 1: Introduction and Background Information

The Water Study Report (WSR) presents information to the Western Springs Village Board for its decision on the water production system (WPS) that will supply the needs of the Village for the coming decades. As explained in the Preface, key components of the existing WPS are close to end of their expected lives, and large expenditures will be required either to renovate the existing WPS using water from deep aquifers, to introduce a new treatment process but retain the remainder of the existing WPS, or to contract with and connect to a supplier of Lake Michigan water. The WSR presents background information on the existing WPS, the design, cost and schedule of the three options for a new WPS, the quantifiable and non-quantifiable benefits of the options, the impacts on the water distribution to the users of the options, the financing of the options and the reviews of the draft WSR by the Infrastructure Commission and the Public Works & Water Committee.

The ground rules for developing each option are:

(1) the proposed WPS will supply adequate, high quality water at a competitive price with high reliability;
(2) different consultants will optimize their designs to meet Rule (1); multiple consultants contributed to the RO option, one of which performed the Lake Michigan option,
(3) all costs and benefits (where possible) will be calculated in $/1000 gallons, with the capital items amortized over a 20 year period.
(4) specifics on the quantity, quality and reliability of the water in Rule (1) will be discussed later.
(5) all consultants promote their option under Rule (2) to produce the most competitive designs.
(6) high cost components such as wells and transmission mains have an expected life much longer than 20 years, so the costs using Rule (3) will be greater than expected but will allow the options to be compared on a uniform basis.

Basic Requirements for the Water Production System (WPS)

A WPS consists of those components used to obtain the water from its source, to treat it as needed and to deliver it to reservoirs that feed the distribution system. As stated to above, any WPS must satisfy requirements for quantity, quality, reliability and economics. Each of these requirements is discussed below for the Village's WPS.

1. Quantity The WPS must meet the continual demand of its users for water, as it changes by the hour, by the day and by the season. Almost all of the water users are residents, and most of them live in single family residences. However, two large users are institutions, LTHS and the WS Service Club. The total annual production is about 500 million gallons (MG), and the total sales are about 400 MG. The difference is due to unmetered uses (e.g. fire suppression) and leakage in the distribution system. Usage, both day-to-day and year-to-year, is most strongly affected by the weather. The average daily production is approximately 1.3 MG. In the winter, it is about 1.0 MG. During the summer it goes up to around 1.6 MG with many days exceeding 2.0 MG. To date, the highest demand days approach 3.0 MG. The daily demand has two peaks, one in the morning from 6AM to 9AM and another in the evening from about 5PM to 8PM. Usage during the night (midnight to 6AM) is very small. Hourly water demand can change by a factor of almost ten during the day, and daily demand can change by

as much as a factor of four over the year. Obviously, a WPS must possess a great deal of flexibility in meeting such a range in demands. The presence of a long term trend in annual water demand in Western Springs is difficult to determine because the large effect of the weather masks the smaller ones. The number of user households is not expected to change significantly. The recently annexed subdivision of Timber Trails will not use village water, no further annexations are foreseen, and very few vacant buildable lots exist within the municipal boundaries. The water usage per household may increase, as homes with hot tubs, Jacuzzis, irrigation systems, and other high usage devises replace the older homes with standard bathtubs, garden hoses, etc. Appendix 8

2. Quality One part of quality is satisfying USEPA requirements, which are set to protect the health of the public. The other part of quality deals with non-health issues, such as taste, appearance and effects on piping, fixtures, appliances, etc. Historically the Western Springs WPS has met the health requirements without special treatments. Currently radium exceeds the maximum allowed concentration in one of the Village's aquifer sources, but is removed sufficiently in the softening process to produce finished water well below the USEPA limit. Lake water must be fluorinated to meet the USEPA requirements, while deep aquifer water naturally contains fluorides within required concentrations.

   Since Western Springs constructed its treatment plant in 1932, the main process was lime softening the aquifer water which currently contains about 16.5 grains (282 mg/L) of hardness. The current plant softens that water to about 142 mg/L of hardness. The treatment has not consistently achieved the desired softness, but has removed iron to a satisfactory level. Calcium deposits can result from the unsoftened water (heating calcium bicarbonate) and by changes with the stability of calcium carbonate in the distribution system. Stains from iron are usually not a problem although they can occur under certain conditions. No treatment is needed to improve the taste of the water from the aquifers.

   Lake water is treated to remove suspended solids that produce turbidity or murkiness. Typically a coagulant is added to bring the solids to the surface where they are removed by skimmers and filters. Lake water hardness runs between 7.5 and 8 grains (129-137 mg/L). Lake water taste and odor may vary with the seasons, and would be most noticeable during late summer.

3. Reliability WPS must be very reliable because water is vital to the community it serves. Even though numerous equipment failures and "acts of God" have occurred in Western Springs over the years, the WPS has never failed to provide the residents with adequate water. The key ingredient of high reliability is redundancy in WPS components needed to provide water to the residents. Examples of redundancy in the current WPS are three wells with one having emergency electrical power, three high lift pumps and three large reservoirs.

4. Economics The current cost of producing finished water in Western Springs is slightly more than $2.00/1000 gallons. This cost does not include the distribution to the users, the metering or the billing, which about doubles the cost. The average household pays about $360/year for water. The cost of lake water varies from supplier to supplier, as will be covered in Chapter 2. The cost range for suppliers within several miles of Western Springs is $2.26 to $2.81/1000 gallons. The capital cost of a transmission main for Lake Water or the associated equipment for aquifer water treatment must also be factored into this calculation.

Description of the Current Water Production System (WPS)

The current WPS consists of three wells, a treatment plant, four storage tanks, the connecting water mains and the associated equipment. These components are described briefly here, but a more detail descriptions were taken from the 1998 WSR and placed in Appendix 2 of this report.

Well #1(Burlington at Wolf) is a shallow well drilled 385 feet into a limestone formation in 1924. Its capacity is about 1000 gallons per minute (GPM), and its static water level has risen over the last twenty years. Although the water meets health requirements, it is extremely hard water (55 grains, 942 mg/L) and would be used only in an emergency, such as the failure of the other two wells. It is seldom used to supply water to the residents. It was rehabilitated in 2006 and prior to that in 1996.

Well #3 (north side of Village Hall) is a deep well drilled 1603 feet into a sandstone formation in 1955. Its capacity is about 1240 GPM and its static water level has risen over the last twenty years. The well has the highest radium level of the Village's three wells, but since it has natural fluoride (at the proper level), low sodium and good taste it is the primary source of water for the Village. It was rehabilitated last in 2003 and prior to that in 1996. An emergency diesel generator would supply electricity to Well #3 only, if needed.

Well #4 (public works yard) is a deep well drilled 1913 feet into a sandstone formation in 1966. Its capacity is about 1100 GPM and its static water level has risen over the last twenty years. Although it has more sodium than Well #3, the quality is its water is good and the well serves as the primary backup when the system demand exceeds Well #3's capacity or when Well #3 is unavailable. It was rehabilitated last in 1998 and prior to that in 1990.

On 90% of the days during a year, Well #3 or Well #4 has the capacity to meet the water demands, including that for fire suppression. On an average day of 1.3 million gallon (MG) demand, the well operates from mid-morning to evening. The morning and evening peak demand periods are met by a combination of "new" production from the well and "old" production stored in the four tanks. At the end of the operating day all tanks are filled for the next day. On the day of the historical peak demand (3.0 MG) Well #3 ran 24 hours and Well #4 about 20 hours.

In the aquifer options three wells would be required, and in the lake option one well would probably be kept in a stand-by mode. Operation of the wells under both the aquifer and lake options is discussed in Chapter 2.

Current Condition of the Water Plant

The main purpose of the treatment plant is to remove calcium hardness (calcium bicarbonate) from the water using the lime-softening method and to add chlorine as a disinfectant. As an added benefit, the lime-softening process reduces the amount of radium and iron to acceptable levels in the water to levels. The major components of the treatment plant include; (1) the lime, alum, carbon dioxide and chlorine feed systems, (2) the spiractor, (3) the accelator or clarifier, (4) the recarbonation basin, (5) the sand filters (four) and (6) the low service (two)

and high (three) lift pumps. Greater detail is taken from the 1998 report and placed in Appendix 5.

The four storage tanks are in chronological order of construction the clearwell, the reservoir, the elevated tank and the standpipe. They provide water during periods in which the demand exceeds the current plant production of the wells. The periods include the morning and evening peak usages and unplanned events, such as those due to fire suppression and large main breaks. All tanks are filled before the start of the next day's morning peak. In addition to their storage function, the elevated tank and standpipe help regulate the water pressure in the distribution system.

Both the elevated tank and standpipe will remain in the WPS, regardless of the decision on the water source, i.e. aquifer or lake. The clearwell and the reservoir would remain with the decision in favor of the lime treatment option, and the reservoir and the clearwell would either remain or be replaced at another location with the choice of the RO option The reservoir but not the clearwell might be part of the WPS in the Lake Michigan option.

Decisions in the Chicago Area between Aquifer and Lake Water

The city of Chicago has relied on lake water almost since its incorporation, while most suburban communities used either shallow or deep wells until the 1950s. Western Springs and other suburbs with open land experienced population growth in the '50s and '60s and, along with this growth, an increased demand for water. The demand exceeded the capacity of the aquifer of existing wells and the water levels in those wells dropped year after year. Western Springs decided in the '50s and '60s to drill two wells into the deep aquifers to obtain reliable and adequate sources of water. At first most of the other suburbs also expanded their well water supply, but then shifted to lake water in the '80s. As explained in the Lake Water Report (Appendix 1) and summarized in Chapter 2, suburbs may receive specific allocations of lake water through international and state bodies. As the number of users of lake water has grown in the past several decades, Western Springs is one of only a few communities in the Chicago area to use deep aquifers as their primary water source. The closest one to Western Springs is Lemont, and most of the other suburbs lie west of the Fox River. Over the period since other villages have abandoned their wells, the water level in the Village's two deep wells #3 & #4 have risen 98 ft and 124 ft, respectively. The basic reasons that Western Springs has previously chosen to continue with its deep aquifer source are (1) an ample amount of good quality water in the aquifers, (2) the relatively long expected lives of its two main wells, (3) the high cost of connecting to a supplier of lake water, (4) an existing water treatment plant, and (5) the rise in the aquifers in this area over the last twenty years.

The study was not able to obtain any documentation of the reasons that the other suburbs chose lake water in the '80s. Any reports on the decision have been discarded over the intervening 20 to 25 years, and those who participated in the decision have retired. The reason that two communities (Plainfield and Shorewood) have recently decided to switch from aquifer to lake water is (1) the expense of meeting new water standards, (2) concern about the sustainability of their aquifer source, and their expanding populations that will increase the demand on their WPSs. The Plainfield and Shorewood examples are explored in further detail in Appendix 1.

Chapter 2: Physical Description of Proposed Lake Water And Aquifer Systems

The following subsections detail the proposed lake and aquifer systems. The first section focuses on a connection to McCook for the supply of water from Lake Michigan. The other three options focus on continued use of the aquifers. Since the deep aquifer wells produce hard water and the radium level in one of the wells exceeds the MCL (Maximum Contaminant level), treatment is necessary. The subsequent subsections contain descriptions of (1) an overhaul of the existing lime softening plant, (2) construction of a Reverse Osmosis (RO) treatment, and (3) construction of an Ion Exchange (IonX) treatment.

Lake Michigan Water Supply

In March 2006, Baxter & Woodman, Inc. (B&W) submitted a Lake Michigan Feasibility Study to the Village, which determined that allocation, supply, and distribution of Lake Michigan water are technically and fiscally possible. In December, 2006 B&W submitted a Lake Michigan Water Supply Study which reviewed the requirements for obtaining and keeping a Lake Michigan water allocation; investigated the system and operational changes associated with this water supply; and selected a preferred Lake Michigan water supplier. Specifically, this study focused on the following areas:

- Detailed review of the water allocation process;
- Ability to supply water during peak demand times and emergencies;
- Case studies of two other communities that recently switched from groundwater supplies to Lake Michigan water;
- Water quality and level of service provided by selected Lake Michigan water supplier;
- Scope and cost of improvements required to supply Lake Michigan water; and
- Village's degree of control over Lake Michigan water supply system.

Lake Michigan Water Allocation History

Lake Michigan has been an important source of drinking water for Chicago-area residents since the mid-1800s. Litigation over Chicago's diversion from Lake Michigan began almost immediately. Legal action culminated in a 1967 Supreme Court Decree, which ordered that Chicago's total diversion from Lake Michigan not exceed 3,200 cubic feet per second (cfs) – the equivalent of 2,068 million gallons per day (mgd) – over a 40-year averaging period. Illinois' diversion consists of three components: domestic pumpage from Lake Michigan used for potable water supply and not returned to the lake; stormwater from the 673-square-mile Lake Michigan watershed; and the direct diversion of Lake Michigan water into the Chicago Sanitary and Ship Canal (CSSC). As of January 2005, there were 205 domestic allocations, for a total daily average consumption of 1,272 mgd or 1,968 cfs, which represents approximately 62 percent of Illinois' total allowable diversion from the lake.

Illinois began exceeding its diversion limit of 3,200 cfs in 1983, and this practice continued through 1996, resulting in a significant water debt. Several improvements have been made to the direct diversion system since 1996. These changes have allowed Illinois to divert substantially less Lake Michigan water than allowed by the Supreme Court Decree, which is leading to repayment of the water debt, and should help Illinois to avoid another water debt in

the future. In response, IDNR is considering applications for new water allocation permits from communities seeking an alternative to their existing water supplies. IDNR has confirmed that it is possible for the Village to reinstate its allocation by following the application process and submitting a formal letter of petition.

Lake Michigan Water Allocation Requirements

The Lake Michigan allocation process is regulated by the Illinois Administrative Code and administered by the IDNR. Major components of the permit applications are:

- Description of geographic area and number of people to be supplied;
- Uses to which the allocation will be put and proportion of allocation that goes to each use;
- Description of existing water system and any proposed improvements;
- Location of wastewater effluent discharges within the water supply area;
- Description of water quality and quantity available from all current sources, and the quantity prospectively available from each source; and
- Anticipated future needs during the proposed allocation period, including projected changes in land use, population, and per capita water use.

In order to receive and maintain a lake water allocation permitees must comply with several requirements imposed by the Department of Natural Resources (DNR) including: water conservation which includes metering, monitoring and possibly watering bans; water use restrictions which limit water usage from May 15 to September 15 and the total amount of water which can be used per year; groundwater usage which requires permittees to establish a program to phase out aquifer usage; storage requirements which equal two times the average daily usage (Western Springs would meet this 2,480,000 gallon requirement); and the requirement for an emergency redundant system such as a connection to a neighboring community.

Lake Michigan Water Treatment and Quality

All potential suppliers evaluated in this report receive treated Lake Michigan water from the City of Chicago's Jardine Water Purification Plant. Activated carbon is added to the water in the plant's intake basin to remove objectionable tastes and odors, and then the water is screened to remove large debris. Alum and polymer are then added upstream of coagulation-flocculation-sedimentation process basins. After sedimentation, the water flows to sand filters, and the final step is fluoride and chlorine addition. Finished water flows from a large clear well through tunnels to several pumping stations, where it is distributed to Chicago and over 100 surrounding suburbs.

Lake Michigan is considered a high quality surface water source. As a surface water source, the raw water has higher turbidity and more variable temperature than Western Springs' existing groundwater supply, and is more vulnerable to biological and chemical contamination, which is why it undergoes extensive treatment as described above. Unlike Western Springs' current water source, the lake water does not contain detectable levels of radium or any other radioactive element, and has low hardness, which makes softening of any kind (ion exchange, lime, etc.) unnecessary when treating this water source. Finished water and distribution system samples are taken frequently to ensure water safety. As Chicago's two most recent available chemical analyses show, water quality parameters in the treated lake water do not exceed any state or federal Maximum Contaminant Levels.

Potential Lake Michigan Water Suppliers

The B&W Feasibility Study evaluated several connection opportunities. The Water Supply Study focused on three of those connections; Burr Ridge, LaGrange Highlands, and McCook, before finally recommending a connection to McCook. At the request of the Infrastructure Commission B&W estimated the cost of a direct connection from the closest Chicago pumping station to Western Springs. The lower cost of water from Chicago did not compensate for the higher capital of the long transmission line, and the Village's Finance Director advised against assuming the large debt for constructing the line..

The Village of McCook receives Lake Michigan water from the City of Chicago, where a booster station pumps a maximum of 18 mgd through a 2.5-mile, 24-inch reinforced concrete transmission main to the Town of Cicero. Here, a second booster station pumps a maximum of 16 mgd through a 5.1-mile, 24-inch reinforced concrete transmission main to the Egandale Avenue Pumping Station on the eastern edge of McCook. The Egandale station, with a peak capacity of 16 mgd, is connected to a system of 16- and 24-inch water mains that serve McCook and the municipalities of Hodgkins, Countryside, and LaGrange. In 2005, pumpage from this station was approximately 7 mgd average and 8.5 mgd maximum. McCook provides chlorination as necessary to maintain appropriate residual in its distribution system.

B&W proposes that Western Springs construct a transmission main from McCook in cooperation with the communities of LaGrange Highlands and Indian Head Park. These two communities have expressed interest in constructing a transmission main directly from McCook if Western Springs were willing to share in the cost.

McCook does not have alternative water sources, but does have emergency measures in place to deal with potential interruptions in their water supply from Chicago. McCook's pumping station and the intermediate supply station in Stickney are only operating at about half of their peak capacity, which provides redundancy in case of pump failure. Additionally, a secondary transmission main running parallel to McCook's primary supply line from the Stickney pumping station provides redundancy in case of a supply main break. Furthermore, all pumping stations within McCook's supply chain and distribution system have at least two back-up power sources.

Since receiving their allocation, McCook has experienced a few water supply disruptions stemming from maintenance and emergency repairs, but in all cases, their water storage facilities (seven million gallons total) have been able to satisfy all demands until the disruptions ended. McCook does not impose restrictions on its customers unless the water supply from Chicago is curtailed. Since Illinois began improvements to the direct diversion system in 1996 (as discussed in Section 2), McCook has not experienced any water supply restrictions other than the summer lawn watering restrictions placed on all Lake Michigan water users by the DNR

McCook charges all customers $2.26/1,000 gallons for all water consumed. McCook has historically raised water rates only to pass on increases from its supplier, Chicago. In past years, rate increases from Chicago averaged less than three percent per year, but rate increases

of about 15% annually have been announced by the city for 2008, 2009 and 2010. In 2008 McCook passed along a 12% increase to municipal customers ($0.25). They have indicated that the 2009 and 2010 increased will be 3% respectively ($0.06).

Infrastructure Improvements Required to Receive Lake Michigan Water

The Village of Western Springs' existing Water Model and a desktop engineering analysis were used to assist in determining the following for each potential supply community:

- Identify a connection point at each community;
- Locate a new water transmission main;
- Calculate the optimum transmission main size to minimize potential pumping requirements;
- Identify additional internal system improvements to receive Lake Michigan water, including pumping stations and pressure reducing stations, and
- Determine what improvements, if any, are required to the existing distribution system to maintain fire suppression flow rates.

A transmission main connection is available at the intersection of East Avenue and 55th Street on the west side of McCook. System pressure at this connection point is approximately 30 to 40 psi. The proposed transmission main route is west on 55th Street to Willow Springs Road, a distance of approximately 7,920 feet. At this point, LaGrange Highlands and Indian Park would branch off to the south, and Western Springs' transmission main would continue north on Willow Springs Road approximately 5,280 feet to the Village's standpipe (Figure 1). The segment of the transmission main running west along 55th Street would be 18-inch, and the segment running north along Willow Springs Road would be reduced to 16-inch.

Based on the pressure provided at the connection point, a booster pumping would be required to fill the Village's standpipe. McCook has already dedicated land for this purpose, so property acquisition would not be an issue. As previously stated, McCook can receive a maximum of 16 mgd from Chicago, so no upgrades should be needed in McCook's water supply.

A Lake Michigan receiving facility would also be required, consisting of a flow meter and control valve in a below grade vault that would control the flow rate from McCook. This facility would be located at the standpipe, and McCook would read the meter and bill Western Springs monthly. Maintenance of the transmission main would have to be negotiated with McCook, LaGrange Highlands, and Indian Head Park. The hydraulic head (pressure) produced by the new pumping station will be greater than that currently produced by the standpipe. Therefore, to prevent overfilling the standpipe while still providing sufficient hydraulic head to fill the elevated tank on the west side of the Village, an altitude valve will be required.

Deep Aquifer Supply

The alternate to lake water is staying on the deep aquifer. The Village currently has two deep wells and a shallow well. Although the deep wells have very good overall water quality, they still need to be treated for hardness and radium. There are several treatment methods available, and the WSG evaluated the three which best suited the Village's situation.

Lime Softening

The first method for treating the water is to stay with the current lime softening plant. As the 1998 study showed, this is a viable process. This alternative is attractive because the Village has operated a lime plant for several decades and can well evaluate the benefits and drawbacks of this type of treatment. Yet, the existing plant would need significant upgrades. Another attractive benefit is that the suggested upgrades could be phased in over several years. Additionally, the improvements have been organized to address the following:

1. Upgrades to maintain the plant in "as is" operation: this option includes replacing completely deteriorated system (accelator) and would not significantly increase production or treatment capabilities. The cost is estimated at approximately $1,000,000.
2. Additional emergency operation: this option would provide for pumps and generators at the 2 million gallon standpipe. Given its current operation, only the upper 1/6th of the standpipe is is used to maintain pressure and meet the demand in the water distribution system. This option would increase the storage supply, extending the length of time the Village could supply water if the production system failed. This cost is estimated at $745,000.
3. Overall operation improvement: this option requires significant overhaul and replacement of several treatment processes including; the change over to a liquid lime system, the change over to a liquid alum system, the change over to a liquid bleach system and the replacement of the recarbonation system, the decommissioning of the current water softener (spiractor), the construction of a sludge dewatering system, the replacement of plant electric transformers and main disconnect, and the upgrade to a variable frequency drive for well #3. Selection of this option would allow the plant to migrate towards a more automated operation which in turn will help produce a more consistent finished water product. This cost is estimated at $2,700,000.
4. Increased supply capacity: this option includes the drilling of a new deep well (Well #5). This option would increase the redundancy of the supply system and allow the Village to produce quantities of water beyond the projected peak demands of the Village. This cost is estimated at $800,000.
5. Increased purification capacity: this option includes the separation and reconstruction of two of the existing sand filters at the water plant and the construction of a remote treatment facility at the proposed well #5. This option would increase the purification capacity of the production system. This cost is estimated at $2,000,000.

To meet the improvements above the Village would need to include various combinations of the following improvements: Depending on the improvements selected, the cost ranges from approximately $1,000,000 to $6,000,000. A detailed description of the projects above and their associated costs are contained in Chapter 3 and in Appendix 2.

Reverse Osmosis

Reverse Osmosis (RO), in this application, is the process of pushing water through a membrane that only allows pure water through to the other side. This option was briefly explored as part of the 1998 water study. At that time it was rejected due to the high capital and operational costs. Since the US Environmental Protection Agency's tightening of certain contaminant regulations in the past decade, the demand for RO has dramatically increased. Conversely, the growing market for these systems has dramatically decreased the costs of obtaining and operating an RO treatment facility.

An RO facility consists of a skid of multiple tubes (24-36 typically) approximately 20 feet long. Each tube contains membranes which trap the molecules larger than water. The membranes are continuously cleaned by water which cannot pass through the membrane, which forms the waste stream. The waste stream usually contains low levels of solids and does not require special permits and can be discharged to the sewer. RO tends to have a relatively large waste stream. Approximately 20% of the water sent to the unit is rejected and sent to waste. The "purified" 80% stream is called permeate. The permeate is essentially pure water. While it may appear counter-intuitive, pure water is not optimally potable. In order to return some of the beneficial characteristics of water including taste with some mineral content, and to reduce operating costs, the permeate is blended with untreated or raw water to achieve the desired finished product. The finished product could contain 30-70% raw water depending on final water parameters and well operation.

The physical description of the RO plant was developed from meetings with companies that manufacture or represent manufacturers of membrane and other RO equipment, with firms that design and build RO plants, from visits to RO plants in northern Illinois and from published information about the considerable number of RO plants that have begun operations in the last ten years.

Using samples from Well #3 and #4 General Electric Water Technologies predicted the performance of their membranes to remove the chemicals. Using these results the WSG performed parametric calculations of the flow streams of a RO plant to provide finished water for Western Springs. From these calculations GE determined the size of the RO equipment and its estimated cost. The WSG next solicited bids for a pilot plant test that would confirm the RO performance with Well #3 water, provide a plant layout and estimate the construction cost of a RO plant to serve Western Springs. The team of Baxter/Woodman (BW) and Corollo Engs. was selected from the three bidders to conduct pilot tests on a single membrane element and provided values for the performance of a RO plant and for its cost. To accelerate the schedule and reduce the consulting costs, the WSG specified that the plant layout and costs be based on a new facility located near Well #4 in the public works area. The results of the BW-Corollo tests, presented in the next chapter, determined that a RO plant would meet the performance criteria for the Village's water supply and estimated conservative plant costs. As will be discussed later, both the performance and cost projections are conservative, compared to an actual plant of approximately the same size treating about the same water composition.

Ion Exchange

Ion exchange (IonX) is a reversible chemical reaction wherein an ion (an atom or molecule that has lost or gained an electron and thus acquired an electrical charge) from solution is exchanged for a similarly charged ion attached to an immobile solid particle. These solid ion exchange particles are either naturally occurring inorganic zeolites or synthetically produced organic resins. The synthetic organic resins are the predominant type used today because their characteristics can be tailored to specific applications.

In the case of Western Springs, calcium, magnesium and radium would be exchanged for sodium ions. This system consists of multiple basins containing a synthetic resin. As the raw water passes through the resin, the ions are exchanged. Like RO, the treated water is blended

with raw water to achieve the required final product. Unlike RO, IonX does not have a large waste stream. Instead, after several hours of operation, the resin is backwashed with a sodium brine to "wash away" the collected ions and regenerate the resin. The resin is designed to last 10 to 15 years.

The WSG visited an IonX plant and discussed this option with consulting engineers. This process has been rejected by the WSG for several reasons. As in 1998, there was concern over changing the chemistry of the water and increasing the sodium levels. Additionally, IonX is only good for exchanging ions and not for removing organic or dissolved solids. In speaking to other municipalities who rejected IonX in favor of RO, they cited the fact that RO can remove both organics and dissolved solids. Additionally, since RO is effective in removing contaminents down to extremely low levels, it enables a municipality to meet any foreseeable changes in EPA. IonX is only suited to react with ionic contaminants.

Chapter 3: Capital and Direct Operating Costs

The WSG has attempted to summarize costs for the above referenced water options. The costs are in 2006 dollars, though Lake Water costs were updated to reflect increases in water rates initiated by the City of Chicago. It is assumed the capital costs will be funded through a 20-year alternate revenue bond, which will be repaid through water rates. This will be further explained in Chapter 8. The end of this chapter also includes a table, which compares the costs between the various water options under consideration.

Lake Water

The most viable lake water option appears to be a direct connection to the Village of McCook. This option is financially possible due to the proposed cost sharing between Western Springs, LaGrange Highlands, and Indian Head Park. The cost of the infrastructure improvements would be prorated according to water usage. This equates to the Village contributing 58% of components that we shared to those shared capital improvements. Without this cost sharing, the total cost of the connection to McCook would be $5 million, with a cost sharing agreement, the Village's cost would be estimated at $3.7 million.

The Village also explored a connection directly to the city of Chicago. While this alternative would allow the Village to purchase water at a reduced rate, the capital cost of the main would exceed $12 million and is cost prohibitive. The entire Lake Water report as well as a detailed analysis of a direct connection to Chicago can be found in Appendix 1. A table comparing the three primary lake water options is below.

Table I. Capital Costs of Three Options for Connecting to Lake Water

	Option 1 Shared Costs With LGH & IHP	**Option 2** Western Springs With no sharing	**Option 3** Direct Connection To Chicago
Transmission Main			
55th & East to 55th & Gilbert	$927,000	$1,597,760	
55th & Gilbert to Standpipe	$1,053,800	$1,053,800	
Contingency (20%)	$396,160	$530,312	
Total Transmission Main Cost Estimate	$2,376,960	$3,181,872	$11,175,000
Receiving Station (incl. tank pump)	$722,500	$722,500	$722,500
Altitude Valve/ Piping	$140,000	$140,000	$140,000
Booster Station	$461,796	$796,200	$1,003,900
Grand Total	**$3,701,256**	**$4,840,572**	**$13,041,400**

In addition to the direct costs listed above, there are also operating cost associated with the lake water option. McCook currently sells water to other municipalities for $2.26 per 1,000 gallons. Over the past five years, the Village has pumped an average of 500,000,000 gallons per year. Purchasing that water would cost the Village approximately $1,130,000 per year. Of that 500,000,000, only 390,000,000 is sold to customers leaving 110,000,000 gallons in unaccounted water. This unaccounted for water is made up of natural loss of water throughout the system, plus municipal usage including main breaks and fire protection. The

110,000,000 gallons difference that the Village would need to purchase but cannot sell is accounted for in the financial calculations. The primary operating costs would include electricity for the booster station and limited chemicals (chlorine). These costs are estimated at $25,000 per year.

The lake water option also offers potential savings over the aquifer options. While these items will be itemized in a table later on, there should be approximately $500,000 per year in chemical savings as well as reduced electrical charges and a reduction in employees. The lake water option could also include the decommissioning of the water plant and the sale of that property.

For purposes of this study, we are utilizing the numbers associated with option #1 (cost sharing with LaGrange Sanitary District and Indian Head Park). Based upon the $3.7 million dollar expenditure and the associated $555,000 of engineering (15%) a bond issue just over $4.2 million would be required.

Lime Softening

The spreadsheet on the following page details the major renovations recommended for continuing lime softening in the existing treatment plant. The spreadsheet follows the outline laid out in Chapter 2 whereby each component improvement is attributed to project category. If this option were chosen, the WSG would recommend all of the improvements be included. It is anticipated that the drilling of an additional deep well and the associated remote treatment would be added in a second phase of improvements.

The first phase of the project would cost approximately $5.3 million dollars depending on how the waste stream is handled. The remaining $2.5 to $3 million for the drilling and treatment of well #5 would take place around 2012 when the some existing alternate revenue (water) bonds are retired. This would free up the ability to issue new alternate revenue bonds to cover the Phase 2 expenditure. Engineering is estimated at an additional 15% which would bring the Phase 1 total to $6.1 million.

The operational cost of the plant would be very similar except for a slight increase in the cost of lime (replacing hydrate lime with liquid lime). The goal of the upgraded plant is to increase the consistency of the finished water by giving the operation better equipment. In turn this will also lead to more automation of the plant. It is not being recommended that the plant be completely automated at this time.

The complete Ad Hoc report on the Lime Softening Upgrade can be found in Appendix 2.

AD HOC COMMITTEE 2006 - WATER PRODUCTION SYSTEM POTENTIAL PROJEC

Village of Western Springs, Illinois

PROJECT COST ALLOCATION TABLE - Tabulation 15 March 2006

	ID	#	COMPONENT DESCRIPTION	ESTIMATED PROJECT COST ($)	PROJECT CATEGORY: ON-GOING OPERATIONS & MAINTENANCE	ADDITIONAL EMERGENCY OPERATION CAPABILITY	OVERALL OPERATION IMPROVEMENT	INCREASED SUPPLY CAPACITY	INCREASED PURIFICATION CAPABILITY	"AS-IS" OPERATION
			CHEMICAL SYSTEMS							
	C	1	Alum system replacement	$ 75,000			$ 75,000			
	C	2	Chlorination system replacement	$ 40,000			$ 40,000			
	C	3	Source 1 chlorination system installation	$ 15,000					$ 15,000	
	C	4	Source 4 chlorination system installation	$ 15,000					$ 15,000	
	C	5	Source 5 chlorination system installation	$ 15,000			$ 15,000			
	C	6	Recarbonation difusion system replacement	$ 20,000			$ 20,000			
	C	7	Ph monitoring system	$ 30,000			$ 30,000			
			SOURCE SYSTEMS							
	S	1	Aquifer source 5 system	$ 800,000				$ 800,000		
	S	2	Shallow aquifer source #1 decommissioning	$ 90,000			$ 90,000			
	S	3	Aquifer source systems O&M		$ 25,000					
			PURIFICATION SYSTEMS							
	P	1	Accelator replacement	$ 900,000						$ 900,000
	P	2	Sand Filters 1 & 2 rehabilitation	$ 80,000						$ 80,000
	P	3	Sand Filters 3 / 4 rehabilitation	$ 80,000						$ 80,000
	P	4	Sand Filters 3 / 4 separation	$ 165,000					$ 165,000	
	P	5	Spiractor subsystem removal	$ 30,000						$ 30,000
	P	6	Recarbonation subsystem replacement	$ 35,000			$ 35,000			
	P	7	Purification Plant influent flow metering	$ 30,000			$ 30,000			
	P	8	Filter washwater pump subsystem replacement	$ 12,000						$ 12,000
	P	9	Additional high lift pump for distribution / backwash	$ 55,000			$ 55,000			
	P	10	Softening solids User Fees	$ 300,000			$ 300,000			
	P	11	Replace hydrated lime system	$ 90,000			$ 90,000			
	P	12	Purification Production O& M		$ 775,000					
			DISTRIBUTION SYSTEMS							
	D	1	Standpipe emergency pump system	$ 150,000		$ 150,000				
	D	2	Standpipe emergency pump O&M	$ 10,000		$ 10,000				
			TREATMENT SYSTEMS							
	T	1	Remote water purification facility	$ 1,400,000					$ 1,400,000	
	T	2	Remote water purification facility O&M	$ 300,000					$ 300,000	
	T	3	Purification Plant solids dewatering system	$ 350,000			$ 350,000			
	T	4	Purification Plant solids building	$ 1,000,000			$ 1,000,000			
	T	5	Purification Plant solids dewatering O&M	$ 40,000			$ 40,000			
			ELECTRICAL SYSTEMS							
	E	1	Purification Plant Transformer Replacement	$ 110,000			$ 110,000			
	E	2	Aquifer pump #3 variable frequency drive	$ 400,000			$ 400,000			
	E	3	Purification Plant Emergency power conversion	$ 200,000		$ 200,000				
	E	4	Standpipe emergency generator	$ 150,000		$ 150,000				
	E	5	Standpipe emergency generator O&M	$ 15,000		$ 15,000				
	E	6	Aquifer pump system 5 emergency generator	$ 200,000		$ 200,000				
	E	7	Aquifer pump system 5 emergency generator O&M	$ 20,000		$ 20,000				
			Totals	$ 7,222,000	$ 800,000	$ 745,000	$ 2,680,000	$ 800,000	$ 1,895,000	$ 1,102,000

Production gallons/year **450,000,000**

Reverse Osmosis

The design and cost information on a RO plant for Western Springs was obtained through a series of contacts with membrane suppliers (in large part GE), from engineering firms (McClure in large part), from pilot plant tests (by Baxter Woodman and Corollo Eng.) and from professional sources (publications, authors, etc). The conceptual plan for the 2.4 mgd capacity RO plant consists of two RO units producing about 500 gpm of permeate each. For the purpose of this study only, the plant is located in the public works area and consists of connections to Wells #3 and #4, pre-treatment filters, a by-pass line, a feed pump for each RO unit, post-treatment, a holding tank (clearwell) and two high-lift pumps. Support equipment such as Clean-In-Place unit, waste disposal, instruments and control system, electrical transformer, etc. are also included. The layout is shown in Appendix B of the BW/Corollo report in Appendix 3of the WSR.

The report describes an operational mode in which Well#3 production is feed into both RO units and Well#4 production is blended with the permeate from the RO units to produce 2.4 mgd of finished water. The flow rate of the waste or concentrate stream is 0.25 mgd. The finished water satisfies the EPA limits for radium and fluoride, and has a hardness of 133 mg/L (7.7 grains) and TDS (total dissolved solids) of 415 mg/L (24.2 grains). The predicted performance was based on the single element test and is conservative relative to that at an actual RO plant with similar well water composition. The cost estimates below are based on the calculated plant performance and thus should also be conservative relative to those of an actual plant, i.e., the Spring Valley RO plant which was visited by the Water Study Group and is comparable to the production level of Western Springs.

The cost for a new plant as described above is $6.9 million. It is possible that cost could be reduced by resizing the plant or by reusing and retrofitting the existing treatment plant. Because it is easier to estimate the cost of a new plant, a cost of $7.1 million was used to represent a new plant and the associated engineering. As with lake water, there will be a reduction in labor and chemicals with the RO option. The comparative costs are summarized in table 3 below.

Annual Costs of Three Options in First and Fifth Years

Annual expenditure data presented for the lake water, RO-treated aquifer water and lime-treated aquifer water are compiled in Table III below. Costs are estimated in current year dollars for both the first and fifth years of operation. Most operating costs increase from the first to the fifth year due to wage and price escalations. An important exception is the production personnel costs for the RO and lake options, where fewer operators will be needed as the operations become routine and personnel either retire or are reassigned to other positions. The table also shows the debt from previous and new capital purchases being reduced during the five years due to payments from water revenues.

Note to readers:
The table entitled "A Snapshot of Annual Water/Sewer Fund Expenditures in 2008" is still in the process of revision. This interim table replaces that in the previous draft of the Water Study Report and will, in turn, be replaced by the final version when the 2008 cost of the Spring Valley plant is received. The text below comments on the current version of the table and will be incorporated into Chapter 3 of the final version of the report.

Comments on the Expenditure Table
The expenditures in the column "Current Plant" are the actual numbers from the Finance Department for the water and sewer in 2007. Note that cost per 1000 gallons is $6.93, but the Village charges only $6.10/1000 gallons. If the current plant were to continue in operation without modification or replacement, the water/sewer rate should still increase by $0.83/ 1000 gallons, as indicated by the last number in the column.

Three options for a new source and/or treatment - improved lime treatment, RO treatment and lake water source - are considered during their first and fifth years of operation. As explained in the Water Study Report (WSR), one consultant estimated the cost of a "custom-designed, high-end" RO plant, and another consultant provided the cost of a "pre-packaged, low-end" RO plant they built in 2002 for Spring Valley, IL. Single cost estimates were provided for the lime and lake options. The table lists the expenditures of the options with both the high($7M)- and low($5M)- end construction costs for the RO option. The builder will provide in the near future the cost of a low-end plant in 2007 dollars to be consistent with the construction costs in the other columns. A conservatively estimated cost of $5M is used until the builder supplies the number. The sewer expenditures are the same for all options.

The costs of water/sewer are calculated for the options in the last three rows. In the first of the three rows, the "total cost per 1000 gallons" uses the common units, which is also the units used in calculating the water/sewer bills of the residents. The second row shows the change in cost from the current charge for water/sewer, i.e., $6.10 per 1000 gallon. However, these costs for the options are based on 100% recovery of expenditures, while the current cost is not, as discussed above. The third row shows how much of the change is due to the selected option, so the difference between the second and third rows is simply the $0.83/1000 gallons of currently unrecovered expenditures.

Note: An attempt was made to express the costs in terms of a "typical" water bill in Western Springs. Water usage varies widely among the residents and with the season of the year, so the concept of a numerical average does not convey any useful information. Suggestions for presenting a "typical" impact of the options on current water/sewer bills are welcome.

Table III. Annual Expenditures Itemized for Operating and Costs during the First and Fifth year of Operation for the Three Options.

A SNAPSHOT OF ANNUAL WATER/SEWER FUND EXPENDITURES IN 2007$

	Currrent	First Year (2007)				Fifth Year			
	Plant	**Lime**	**RO (high)**	**RO (low)**	**Lake**	**Lime**	**RO (high)**	**RO (low)**	**Lake**
Water									
Administration[1]	$270,786	$270,786	$270,786	$270,786	$270,786	$280,264	$280,264	$280,264	$280,264
Production[2]	$996,172	$996,172	$757,280	$757,280	$342,500	$1,072,690	$595,500	$595,500	$123,500
Capital Repair	-	-	-	-	-	$25,000	$5,000	$5,000	$5,000
Water Purchase[3]	-	-	-	-	$1,130,000	-	-	-	$1,356,000
Distribution (includes $50K capitol)[4]	$252,113	$252,113	$252,113	$252,113	$252,113	$260,937	$260,937	$260,937	$260,937
Meter Reading (includes $25K meter repl)	$82,436	$82,436	$82,436	$82,436	$82,436	$98,923	$98,923	$98,923	$98,923
Annual Debt Service (existing)	$581,323	$581,323	$581,323	$581,323	$581,323	$507,013	$507,013	$507,013	$507,013
Annual Debt Service (new)[5]	-- none --	$387,889	$445,118	$317,942	$267,071	$387,889	$445,118	$317,942	$267,071
Bond Issued	-- none --	6.1M	7M	5M	4.2M	6.1M	7M	5M	4.2M
Sewer	$520,643	$520,643	$520,643	$520,643	$520,643	$600,000	$600,000	$600,000	$600,000
GRAND TOTAL	**$2,703,473**	**$3,091,362**	**$2,909,699**	**$2,782,522**	**$3,446,872**	**$3,232,716**	**$2,792,755**	**$2,665,578**	**$3,498,708**
PRICE PER 1000[6]	**$6.93**	**$7.93**	**$7.46**	**$7.13**	**$8.84**	**$8.29**	**$7.16**	**$6.83**	**$8.97**
Gross change from current price per 1000[7]	**$0.83**	**$1.83**	**$1.36**	**$1.03**	**$2.74**	**$2.19**	**$1.06**	**$0.73**	**$2.87**
Part of change due to increase cost of Option per 1000[8]		**$0.99**	**$0.53**	**$0.20**	**$1.91**	**$1.36**	**$0.23**	**$0.10**	**$2.04**

(1) Actual 2007 Administration costs. 3.5% increase added to fifth year
(2) Actual 2007 Production costs include personnel and chemicals
(3) Water purchase assumes 20% increase by year five from Chicago rate increases
(4) Actual 2007 Distribution Costs. 3.5% increase added to fifth year
(5) Assumes uniform bond payments. 2.5% Interest over 20 years.
(6) Numbers based off of 390M gallons sold and 500M gallons produced.
(7) Current price per 1000 gallons is $6.10
(8) Costs of option above/below 2007 cost per 1000 gallons

Chapter 4: System Distribution Analysis

The Western Springs Water Model was used to confirm recommended transmission sizes and connection points, and to ensure adequate system operating pressures for the lake water option. Water modeling results indicate the transmission system from Chicago must deliver water at a minimum pressure of 51 psi at the standpipe in order to fill both the standpipe and one-million-gallon elevated tank on the west side of town. That pressure is similar to the Village's current operating pressure.

The fire flows produced in the lake water supply alternative were compared to the base line water model from the Village's current water system. The available fire suppression flow rates were only minimally different. The worst case was an original fire suppression flow rate of approximately 8,200 gpm that was reduced to about 7,000 gpm.

The proposed plan to use the standpipe as a receiving point allows the system to float off of the pressure supplied by the booster station of the supplier. The WaterCad model was used to establish what pressure was required to fill the standpipe and then operate the system. It's important to note that this will result in similar operations to existing system. Instead of the water treatment plant providing supply pressure, the connection to a supplier provides the supply pressure.

Earlier analysis considered different supply points that may have affected the distribution system. By utilizing a connection point at the standpoint, significant distribution changes are minimized.

Chapter 5: Quantifiable Benefits of the WPS options

In addition to differences in the capital and operating costs of the lake and aquifer options, the three options for a WPS also differ in other ways that can be quantified in terms of $/1000 gallons. Seven areas of differences have been identified, and each will be discussed below. Although the differences can be quantified, only very approximate data are available for the quantification, so the results are presented in a table at the end of the chapter in terms of broad ranges of benefits or penalties. The details of the calculating them are given in Appendix 6.

1. System Capacity – The amount of water that the Village can sell to its residents is limited by either contractual agreements or the capacity of the WPS. The greater the amount of water the Village sells, the lower the rate it can set to pay for the fixed costs of the total system, such as the distribution system, some labor costs, etc. A lower rate of an option is a quantifiable benefit of that option. In the lake option the water amount is limited by the agreements with the DNR and our immediate supplier, which is proposed to be the Village of McCook. The daily average amount would be 1.2 MGD and the peak daily amount is twice that, or 2.4 MGD. In the aquifer options the sales are limited by the peak output of the wells or about 3.0 MGD. Plant production records show that on an average an additional 400,000 gallons of aquifer water would be sold on four days in a year when the demand exceeds 2.4MG. The benefits are estimated in Appendix 6 using the marginal costs of the additional water produced from both the lime-softening and RO processes, and the results presented in the table at the end of this chapter.

2. Impacts of Water Restrictions – Some municipalities impose water use restrictions to meet the allocations of lake water by the IDNR, such as limiting the hours of lawn watering and car washing or requiring water saving appliances. No restrictions are imposed under the aquifer options. One impact of watering restrictions is the possibility of damage to landscaping. For example, during the drought in the summer of 2005 many lawns suffered from the lack of water due to the restrictions and needed extensive repairs the following spring. The second impact of restrictions is the reduced revenues from water sales. The cost of repairing damaged landscaping can only be roughly approximated because of the uncertainty in predicting droughts and the lack of data on costs attributed to repairing drought damage. Estimation are given in Appendix 6, and the results presented in the table at the end of this chapter. Data on the reduction in use due to restrictions has not yet been obtained. When it becomes available, this part of the report will be revised, and the results added to the table below.

3. Hardness, Total Dissolved Solids and Suspended solids – Hardness in water shortens the life of many components and appliances that are part of a home's water system. Examples are water service lines, pipes, filters, valves, faucets, water heaters, humidifiers, etc. Total dissolved solids produce a solid film on glasses and dishes in the drying cycle of a dishwasher, which can result in a permanent loss of appearance. Changes in water temperature and chemistry cause some dissolved chemicals to precipitate out. Fluctuating hardness levels, changes in the Langelier Index ($CaCO_3$ stability), treatment by-products ($CaCO_3$, $Mg(OH)_2$, $Al(OH)_3$), misc. iron and silica compounds all play a part in problems that occur in distribution The cost associated

with this damage is difficult to determine for each option, but a very approximate estimate is calculated in Appendix 6 and presented in the table below.

4. Reliability of Supply – Under the lake water option, the Village would not have a lake water source independent of McCook, because both of our emergency connections, i.e., LaGrange and Indian Head Park, also receive water from McCook. Even though McCook is a highly reliable supplier of water, Well #3 would need to be kept in stand-by service to provide the reliability of a second independent source of water. In the case of aquifer water, reliability is currently satisfied by the connections to the LaGrange and Highlands Water District and stand-by Well#1. When Well#5 is brought into production, it will have emergency power that will satisfy the reliability requirements. The lake water option has a quantifiable cost "penalty" of maintaining Well#3, which is estimated in Appendix 6 and given in the table below.

5. Sale of Surplus Property – With the lake option the treatment plant, with the exception of the 500,000 gallon reservoir, would become surplus and assumed to be sold. The lime-softening option would not result in any sale of surplus space at the treatment plant. The RO option with the plant located in the existing treatment plant would allow the sale of the building space except for the clarifier, the HLPs, emergency power connections, Cl injection system and the reservoir, while the RO option with a new plant in the public works area would result in the treatment plant become surplus with the possible exception of the reservoir. Appendix 6 contains the estimated sale price, demolition cost and building space rates, which are used to calculate the benefits that appear in the table below.

6. Timing of the Capital Improvements – In the lake water option all capital expenditures need to be made at the beginning of the project mostly for the main from McCook to the standpipe. In both aquifer options the capital expenditure for Well#5 may be delayed years after the expenditures for a new or renovated treatment process. The benefit from the time delay in committing the construction cost for the aquifer option is calculated in Appendix 6 and shown in the table below.

(Bill, To be consistent Item #6 should apply only if the costs of the optional capital expenditures are included in the water costs ($/Kgal) for the aquifer options. I don't think they are for the RO option and don't know whether they are for the lime option. I have amended above Item #5 to take into account locating the RO plant in the public works area. The same comment applied to Item #5 for the RO plant in the public works area.)

Table IV. Benefits or Penalties of the Three Options

	Lake	Lime	RO
System Capacity		+1	+1
Water Restrictions	-2		
Impact of Hardness		-2	
Reliability of Supply	-1		
Surplus Property	+1		+1
Timing of Costs		+4 (?)	+3 (?)

-5 -4 -3 -2 -1 0 1 2 3 4 5

Table V. Impacts on Price per 1,000 Gallons

	Lake	Lime	RO
System Capacity		**Small Pos.**	**Small Pos.**
Water Restrictions	**Medium Neg.**		
Impact of Hardness		**Large Neg.**	
Reliability of Supply	**Small Neg.**		
Surplus Property	**Small Pos.**		**Small Pos.**
Timing of Costs		**Medium Pos. (?)**	**Medium Pos.(?)**

Price Impact per 1,000 Gallons
Large: $0.25 - $1.00 **Medium: $0.10 - $0.25** **Small: $0.01 – $0.10**

Chapter 6: Intangible Issues in the Choice of the Water Option

Some factors that may influence the decision between lake and aquifer water cannot be quantified into a cost or benefit in terms of $/1000 gallons. In some cases there is no quantitative measure, such as taste of one source versus another; and in others there is no information to make a judgment, such as the amount of water available from a source in the future. In this chapter, these issues will be presented to be sure that the reader is aware of them and may (or may not) include them in his/her evaluation of the options.

1. Taste and Odor of Lake and Aquifer Water – Residents in Western Springs have many occasions to drink lake water, when they visit almost any of the municipalities in the Chicago area. Most of those who have been asked do not mention a significant difference between lake and aquifer water. A few do express a preference for one or the other, and some of those have a strong dislike of the other source. Chemical analyses have shown that aquifer water has more dissolved salts (minerals) in it than lake water, but lake water has more issues with algal (MIB and Geosmin) and bacterial activity., Both meet the EPA health requirements.

2. Control over the Supply and Cost of Water – Purchasing lake water from a supplier on a stated price schedule and stated quantity is done under a long term, renewable contract. The basic quantity is determined by DNR, which is part of an international (Canada) government bureaucracy. The price is negotiated when a contract is signed or renewed. There is some recourse to increases in prices, but the supplier can pass along justifiable costs. The purchaser would probably be faced with a large capital expense to connect to another supplier, if he did not renew the contract with the current supplier. The experience of most purchasers of lake water has been good, but there are exceptions. The supplier of aquifer water is the municipality itself, so there is no price negotiation or connection to another supplier. Of course, that does not mean that prices will not increase, nor that there will always be an adequate supply in the aquifer.

3. Long Term Availability of Water Source – The answer to this issue is beyond current knowledge, but a few facts should be mentioned about the lake and aquifer sources. It is very difficult to imagine the Great Lakes running dry, but its waters are being rationed (or allocated) now, and new communities (e.g., west of the Fox River) are looking to the lake for their water. If Western Springs were to receive an allocation, it would keep it forever but the amount could change. The history of aquifers (broadly known as ground water) shows that the shallow wells were first used. As the population using these wells grew substantially, new wells were then drilled to the deep aquifers. Over time, the water level in the Chicago area wells dropped and as lake water became available most villages switched their source. Western Springs did not, and the level of water in our wells has risen. Presently the water levels in the deep wells of towns west of the Fox River have dropped, as the general population has grown in those areas. At this time, no one knows for sure how the use of the deep aquifers west of the Fox River will impact the deep wells in Western Springs. It is possible that, at some point, restrictions on water from the deep aquifers will be imposed just as there is not with lake water.

4. Ability to Respond to External Changes – The basic issue here is whether a small town like Western Springs would be better off in a large group of lake water users or in the small group of aquifer users in this area. As an arbitrary example, assume that US government wanted to mandate a big change in water regulation. IDNR and the State of Illinois have financial and political resources to resist any negative impact on users in the Chicago area, but Western Springs and the few other towns using aquifers do not. Currently there are no such issues, so the matter is hypothetical but for how long?

5. Future EPA Regulations – New EPA and other regulations can have a major impact on water production system, as witnessed by those that had to reduce the amount of radium when the EPA began enforcing the allowable amount of radium. Hundreds of communities had to purchase and install new treatment equipment to meet this requirement. To our knowledge the EPA is not now planning any major change in the drinking water regulations that would impact the lake and aquifer choice, but changes cannot be predicted 20 years ahead. Changes in regulations general affect either surface (i.e., lake) or ground (i.e., aquifer) water, but not both. One area of possible future regulation of surface water is that of organic compounds, which may be part of the runoff from industrial plants or farms. Another is mercury in the atmosphere that comes to the ground in rain. Changes in ground water may be in the area of metals, such as zinc, aluminum, or sodium, for which the EPA now has advisory (non-mandatory) guidelines. Changes in allowable concentrations of discharge streams would impact the aquifer options, most likely in terms of costs. Since future changes in the EPA regulations are not known, these issues are presented as intangible ones.

6. Number of Suppliers – In one way a large number of suppliers is good for the customer because it encourages competition. For lake water there is only one ultimate source, but there are many local suppliers available to the Village. For aquifer water systems there are several suppliers of treatment equipment and several firms that drill wells, although one is dominant in our area. Both options require significant amounts of electricity and a modest amount of labor. Based on this information the impact of changes in operating and maintenance costs would not differ greatly between the options with the possible exception of the waste discharge costs of the lime softening process. MWRD now takes the waste at a significant cost to the Village, and alternate disposal means are not now attractive.

   In different way, a large number of members in the supply chain of lake water is not good, because the costs and performance of each would be passed along to us with little or no choice of alternate suppliers.

7. Reliability of Electrical Power - Aquifer options already have an emergency power for Well#3 to supply water to distribution. The suppliers of lake water also have emergency power for pumping, but any cost of increasing the reliability of electric power of the suppliers would be passed on to the communities that buy the water from them. However, no plans are known at this time to increase the reliability of their systems, so the possibility of increased cost of lake water is an intangible issue.

9 8. Impact ofPhysical Differences in Lake and RO-treated (new plant) Water compared to Lime-treated Water. Under the lake and RO (new plant) options water would enter the distribution system at a different location from the current one, which may result in changes in water pressure, flow rates and flow directions throughout the distribution system. The changes in pressures and flow rates in the system could result in main breaks, and the changes in flow direction could negatively impact the water quality over a period of time. another difference with lake and RO-treated water that may impact the distribution systems is. chemistry.. The differences in chemistry of these waters may result in dissolving some of the "protective" coating on the pipes and joints that has built up over many years and in corroding of the metal in the pipes themselves, which may introduce metals in the drinking water and/or result in breaks in the pipes. A few examples of problems with the distribution system caused by changing to lake water in the 1980s were recalled, but our consultants did not find any recent reports of main breaks, corrosion, etc. after switching from aquifer to lake water. Since distribution systems are not identical with respect to the factors that may result in problems with the introduction of lake and RO-treated water, no certainty exists whether there would be problems or not, and thus quantifying penalties are not attempted in this study. An impact just in the case of lake water results from its temperature varying from summer to winter, while aquifer water has a constant temperature. With lake water the pipes of distribution system would expand and contract during the year, which may result in breaks due to cyclic stresses. As in the case of chemistry difference, undocumented reports from the 1980's attributed main breaks to the swings in water temperature after a switch to lake water was made, but more recent experiences have not supported this hypothesis Transition from the Current to the Selected Option for the WPS - During the transition from the current system of lime treatment of aquifer water to the selected option, the Village must continue to supply its customers daily with potable water reliably and free from significant temporary expenses. The conversion from the old WPS to the new one should appear seamless as possible to the users, even to the extent of blending the water from the old and the new system over a period of time to avoid any sudden changes in taste to the users and unexpected impacts on the distribution system. Consideration of the transitional period was brought to mind by the description of actual problems that occurred when a new municipal WPS replaced an old one. The old had been decommissioned, but the new one did not operated properly, so the town had to buy water on a temporary and expensive basis, while the problems with the new plant were solved. This situation caused undue expenses to the users, cast suspicion on the water from the new plant and gave the town a "black eye" from its mismanagement.

The lake water option seems unlikely to have problems during the transition because it would be built and tested before the current plant is decommissioned. It also may be possible to operate both systems for a short time to allow the residents and water system to adjust to the "new: water. The same evaluation is made for an entirely new RO plant that would be built and tested while the current one was still operating. Since both plants would be entirely under the control of the Village, the introduction of the ROI-treated water could be scheduled without outside approvals.

Placing the RO units in the existing WTP would necessitate removing some water treatment equipment, so a transitional period would exist in which the water would not be fully treated, although it would always meet the health standards. The same situation would occur in the case of the lime option, where treatment equipment would be removed and replace during the rehabilitation of the plant. Again the finished water would not be as fully treated as before, but would always meet the health standards. These types of transition have been successfully accomplished, but good planning is required. There is, however, an unknown possibility of unexpected problems that would force the Village temporarily to purchase replacement water.

In a relative assessment, the lake and entirely new RO plant options have better change of a good transition from the current to their implementation than the lime option or the RO units in the old plant. This possibility of a good transition has not been quantified, however, so the issue of transitional operation is placed in the intangible category.

Chapter 7: Schedules for Aquifer and Lake Water Systems

Reverse Osmosis

This option could have the shortest timeline for implementation. The first step would be to solicit proposals from design engineering firms and then award and design the new system. It is anticipated that could take approximately 6 months. since the Village has already conducted a pilot study, the results of that could be used to fast track the new design. Implementation would vary depending on whether a new plant were constructed, or if the exiting plant were retrofitted. Should the design be for a completely new plant, construction could occur at any time since the existing plant would stay in operation. The total design and installation time would be approximately two years. If a decision were made within the next few months, the new system could be operational by the spring of 2010.

If the existing plat were retrofitted, implementation would ideally occur in the slower fall and winter months and are anticipated at another year. The phasing would include replacing the existing transformers. The plant would then be set to run just on the spiractor. The RO installation process would require the demolition of the accelator and east filters. The new equipment would be located in this location. The internal piping of the plant would be modified to accommodate the new flows directly to the RO skids.

Lime Treatment

This option has been more extensively engineered than the others. Assuming the Village retains the existing consultant, this package could be assembled and out to bid in relatively short order, approximately 3 months. Should the Village choose to seek competitive proposals for consulting services, the process would likely be extended another 3 to 6 months.

Due to the complexity of this project and the required sequencing of the plant, the installation process could extend over one year. The first phase would be to replace the transformers and then install the new accelator. Subsequent projects would include the replacement of the lime and alum systems and the eventual construction of a sludge de-watering building. The final phase of the project would be the drilling of a third deep well and the construction of a remote treatment facility.

Lake Water

The lake water option would potentially have the longest time line because of the intergovernmental and permitting processes. The first phase would be negotiations with LaGrange Highlands and Indian Head Park to form an intergovernmental agreement for cost sharing. The second phase would be for Western Springs to apply for a new lake water allocation. It is anticipated that this would take 9 months to a year. This item could run concurrently with the intergovernmental negotiations.

Once the above items were complete, designs for the transmission main could be prepared and bid. It is anticipated this process could take 3-6 months. Once bids were prepared, easement agreements would need to be secured for the placement of the new main. It is anticipated that the main would run in State ROW. This process could take 6-9 months. The project would then be ready to be bid and constructed. In all, it is anticipated the total time from the

Village's selection of lake water as the new source for Western Springs to the actual receipt of water into the Village's system would take approximately 3 years.

Chapter 8: Financials

None of the three options presented can be implemented without issuing bonds. The current water/sewer financial reserves do not contain enough resources to pay for any of the discussed options outright.

Using debt (generally a General Obligation Alternate Revenue Source instrument) to finance projects instead of banking annual surpluses allows the Village to complete the project on a timely basis and structure the repayment over a 20 year period. A longer maturity schedule also assists in establishing a manageable annual payment amount without encumbering the resident with significant increases. The use of General Obligation Alternate Revenue Source Bond, while marketable, does require the Village to maintain 125% bond coverage.

Ideally, the Village would still pursue a low interest loan from the IEPA. This process is still considered debt issuance, but is more like a 20 year mortgage than the issuance of bonds. Although the Village was unsuccessful in its first attempt at a water loan through the IEPA, the Village did successfully secure an IEPA loan for sewer work in 2003. It is believed that the same formula can be followed to secure a new loan for the water production system.

It is unlikely the Village would ever secure an IEPA loan based upon need. Therefore, the Village would need to seek funds through the loan bypass system. This system is the same as the formal loan process except that bypass loans are only granted after compliance projects are funded. The IEPA has indicated that there is always sufficient bypass funding for several projects.

IEPA loans are generally funded over 15 to 20 years. The rates do not fluctuate daily like conventional mortgages, but are set annually by the IEPA. Yet, once a loan is secured, that rate is set for the life of the loan. In 2007 the loan rate was 2.5%. That rate was used in all of the financial calculations.

Historically, water demand has consistently, centered around 390,000 thousand gallons annually. Using that consumption as a benchmark, and the above interest rate, the water/sewer rate would need to increase by approximately 35 cents for every $100,000 of annual debt service payment. Please note that a Lake Michigan allocation may not allow the Village to sell additional water during period of drought because of mandated restrictions. These restrictions will reduce the Village's ability to capture the needed revenue. Additionally, the Village does not sell all of the water that flows through the distribution system due to leakage in pipe joints and valves, main breaks, malfunctioning water meters (that read inaccurately), main breaks, and other municipal usage.

Chapter 9: Review by the Infrastructure Commission

The Water Study Report was reviewed by the Infrastructure Commission on multiple occasions. Several of the Commission's comments and recommendation were included in this final Water Study Report.

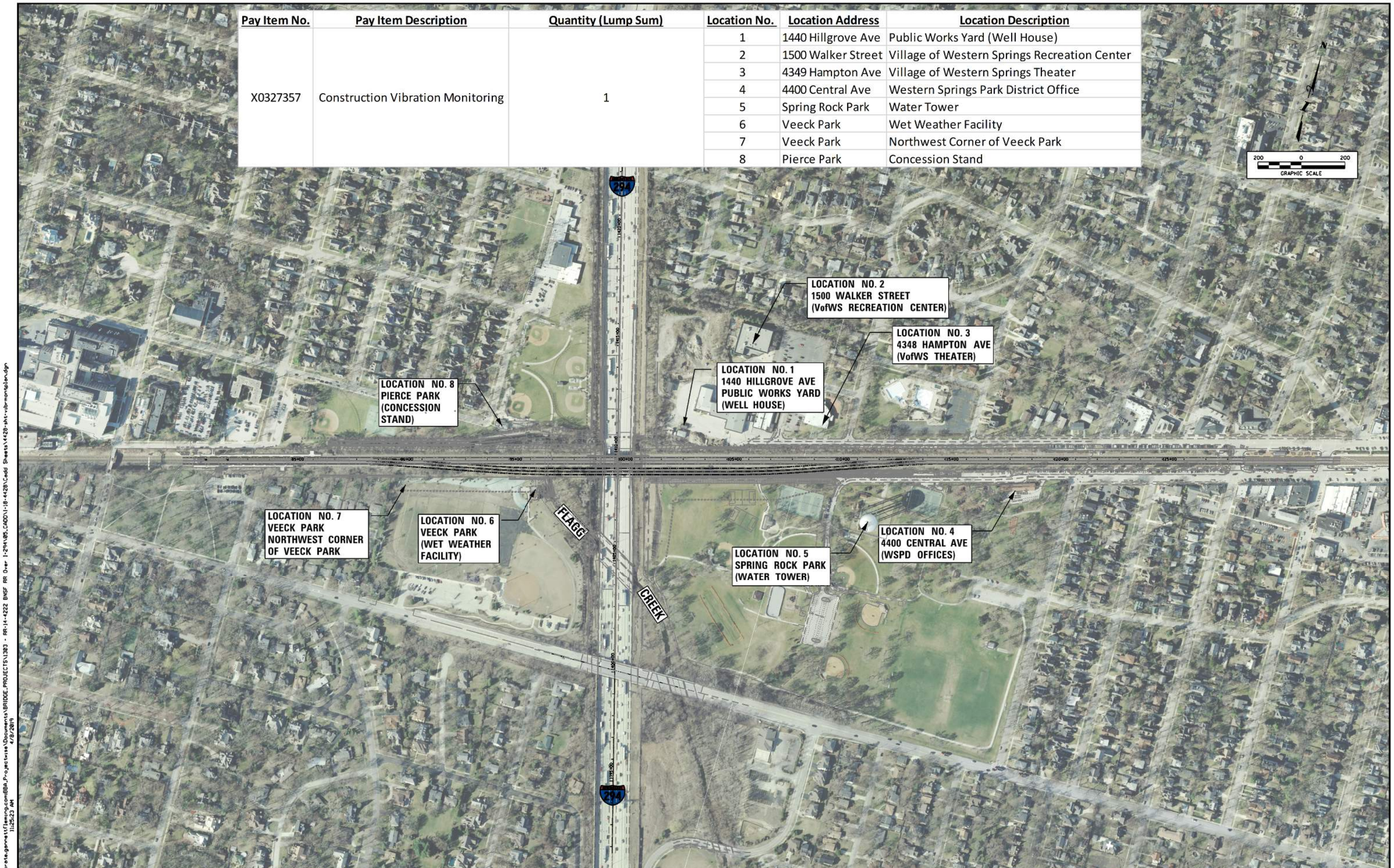
The Commission has not seen a copy of the final report for review and further recommendations.

Chapter 10: Recommendations by the Public Works and Water Committee

The Public Works and Water Committee (PW&WC) will make recommendations to the Board actions for completing the Water Study Report and producing the final report by August, 2007. At its April meeting the PW&WC recommended that the Village Board request bids for a pilot plant study of a RO treatment of Well#3 and Well#4 water. The purpose of the study is to confirm the technical feasibility of using RO process for treating our deep aquifers water and to obtain operating data for the design of the full scale plant. If the results of the study support the preliminary information the Village has on the RO process, the next step would be for WSG to incorporate the results into the WSR and for the PW&WC to review and present it to the Village Board for a decision on the water source and treatment..If the test results do not support the preliminary findings, the PW&WC will consider the next course of action to complete the WSR.

At almost all of its meetings since the inception of the WSG in October, 2005, the Public Works & Water Committee (PW&WC) has received and discussed reports on the water study. The PW&WC recommended to the Board awarding contracts to the consultants for studying the three options for the water source and treatment. On one occasion the kick-off meeting for the RO pilot plant tests was held at part of a PW&WC meeting. The Committee reviewed the draft WSR in April, 2007 and recommended its release to the Infrastructure Commission (IC) and, in turn, to the Board. The PW&WC also reviewed the final draft of the WSR in March, 2008 and recommended that it be presented to IC and the Board. At that time the PW&WC chose not to make a recommendation with respect to the choice of water source and treatment. As stated in the Introduction of this report, the intent of the WSG is to present the Board information on the three options and to await its decision on whether it wishes to receive a recommendation on the water source and treatment option.

Pay Item No.	Pay Item Description	Quantity (Lump Sum)	Location No.	Location Address	Location Description
X0327357	Construction Vibration Monitoring	1	1	1440 Hillgrove Ave	Public Works Yard (Well House)
			2	1500 Walker Street	Village of Western Springs Recreation Center
			3	4349 Hampton Ave	Village of Western Springs Theater
			4	4400 Central Ave	Western Springs Park District Office
			5	Spring Rock Park	Water Tower
			6	Veeck Park	Wet Weather Facility
			7	Veeck Park	Northwest Corner of Veeck Park
			8	Pierce Park	Concession Stand



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DRAWN BY	JK	SCALE	1"=200'
CHECKED BY	DF	DATE	$DATE

Gannett Fleming

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. I-18-4428

VIBRATION MONITOR LOCATIONS

SHEET NO. VM-01
DRAWING NO. 17A OF $TOT