REFER TO SHEET 5

REFER TO SHEET 6

REFER TO SHEET 8

REFER TO SHEET 9

PROPOSED PRESSURE REDUCING VALVE AND OUTLOT TO BE DEDICATED TO THE CITY OF CRYSTAL LAKE

PROPOSED PRESSURE REDUCING VALVE AND OUTLOT TO BE DEDICATED TO THE CITY OF CRYSTAL LAKE

WYOMING WAY

HAMILTON DRIVE

GLENGARY CIRCLE

RIVER BIRCH BLVD

ARDMOORS DRIVE

PURDUE PLACE

DRAKE DRIVE

COLLEGE HILL SUBDIVISION

EXISTING PRESTON PINES UNIT 1

8" SANITARY SEWER (TYP.)

EXISTING DRAIN TILES ON SITE TO BE REMOVED (TYP)

ARROWS REPRESENT PROPOSED LOCATIONS OF DITCH SYSTEMS TO BE PLACED WITHIN OUTLOTS IN ORDER TO COLLECT WATER OFF STEEP SLOPES (TYP ALL)

EXISTING STORM SEWER AND TEMPORARY DETENTION BASIN SHALL BE REMOVED

DROP SMH
INV 896.80(W,S)
INV 891.41(E,N)

INV 889.00
8" SANITARY SEWER (TYP)

EXISTING 12" WATERMAIN TO BE REMOVED

LANDSCAPE BUFFER/OUTLOTS TO SERVE AS TREE PRESERVATION AREAS (TYP ALL)

ELECTRICAL FEED TO WATER TOWER TO BE DISCONNECTED AND REROUTED

KEYMAP

N

SCALE 1" - 100'
0 100 200

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9575 W. Higgins Road, Suite 500
Rosemont, IL 60018
(847)696-1400
www.mackieconsult.com

CLIENT:
CalAtlantic Homes
1141 East Main Street, Suite 108
East Dundee, IL 60118
Phone: 224-293-3100 Fax: 224-293-3101

DATE	DESCRIPTION OF REVISION	BY

DESIGNED	MTL
DRAWN	DWP
APPROVED	AJM
DATE	01/26/2018
SCALE	1" = 100'

PLAN - CENTER SOUTH
WOODLORE ESTATES
CRYSTAL LAKE, ILLINOIS

SHEET 7 OF 10

PROJECT NUMBER: 3144

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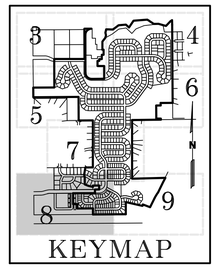
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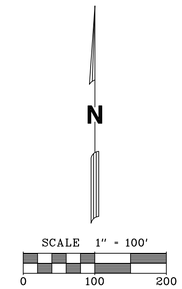
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EXISTING STORMWATER MANAGEMENT FACILITY #1
TRIBUTARY AREA = 11.46 ACRES
DETENTION STORAGE REQUIRED: 2.62 AC-FT
COMP. STORAGE REQUIRED: 1.35 AC-FT
TOTAL STORAGE REQUIRED: 3.97 AC-FT
STORAGE PROVIDED: 3.97 AC-FT
NWL = 903.00
HWL = 907.44
HWL W/COMP STORAGE: 909.00

REFER TO SHEET 7

REFER TO SHEET 9





EXISTING STORMWATER MANAGEMENT FACILITY #2
TRIBUTARY AREA = 20.10 ACRES
DETENTION STORAGE REQUIRED: 6.15 AC-FT
COMP. STORAGE REQUIRED: 0.00 AC-FT
STORAGE PROVIDED: 6.43 AC-FT
NWL = 903.00
HWL = 909.50

PURDUE PLAZA
MAYHAW DRIVE
EXISTING PRESTON PINES UNIT 1
EXISTING PRESTON PINES UNIT 2
RIVER BIRCH BOULEVARD
HONEY LOCUST DRIVE
CARPATHIAN DRIVE
BLACK CHERRY DRIVE
CIMMERON CIRCLE
ILLINOIS ROUTE 31
COMED ROW
FUTURE CARPATHIAN DRIVE
EXISTING CITY OF CRYSTAL LAKE WATER TOWER
PROPOSED 8" WATERMAIN TO CONNECT TO EXISTING WATERMAIN V1A 8"x12" PRESSURE CONNECTION
PROPOSED STORM STRUCTURE TO BE CONSTRUCTED OVER EXISTING UNIT 1 OUTLET PIPE
CONNECT TO EX SMH INV 904.10
8" SANITARY SEWER (TYP)
PROPOSED 8" WATERMAIN TO CONNECT TO EXISTING STUB
EXISTING DRIVE APRON TO BE REMOVED AND PROPOSED RIVER BIRCH BOULEVARD TO MATCH EXISTING ROADWAY
PROPOSED 8" WATERMAIN TO CONNECT TO EXISTING VALVE VAULT WITH REDUCER
STORM SEWER TO CONNECT TO EXISTING STORM STRUCTURE AND EXISTING DETENTION BASIN INFALL
EXISTING UTILITIES CONSTRUCTED AS PART OF PRESTON PINES UNIT 2 TO BE REMOVED

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DATE	DESCRIPTION OF REVISION	BY

DESIGNED	MTL
DRAWN	DWP
APPROVED	AJM
DATE	01/26/2018
SCALE	1" = 100'

PLAN - SOUTHWEST
WOODLORE ESTATES
CRYSTAL LAKE, ILLINOIS

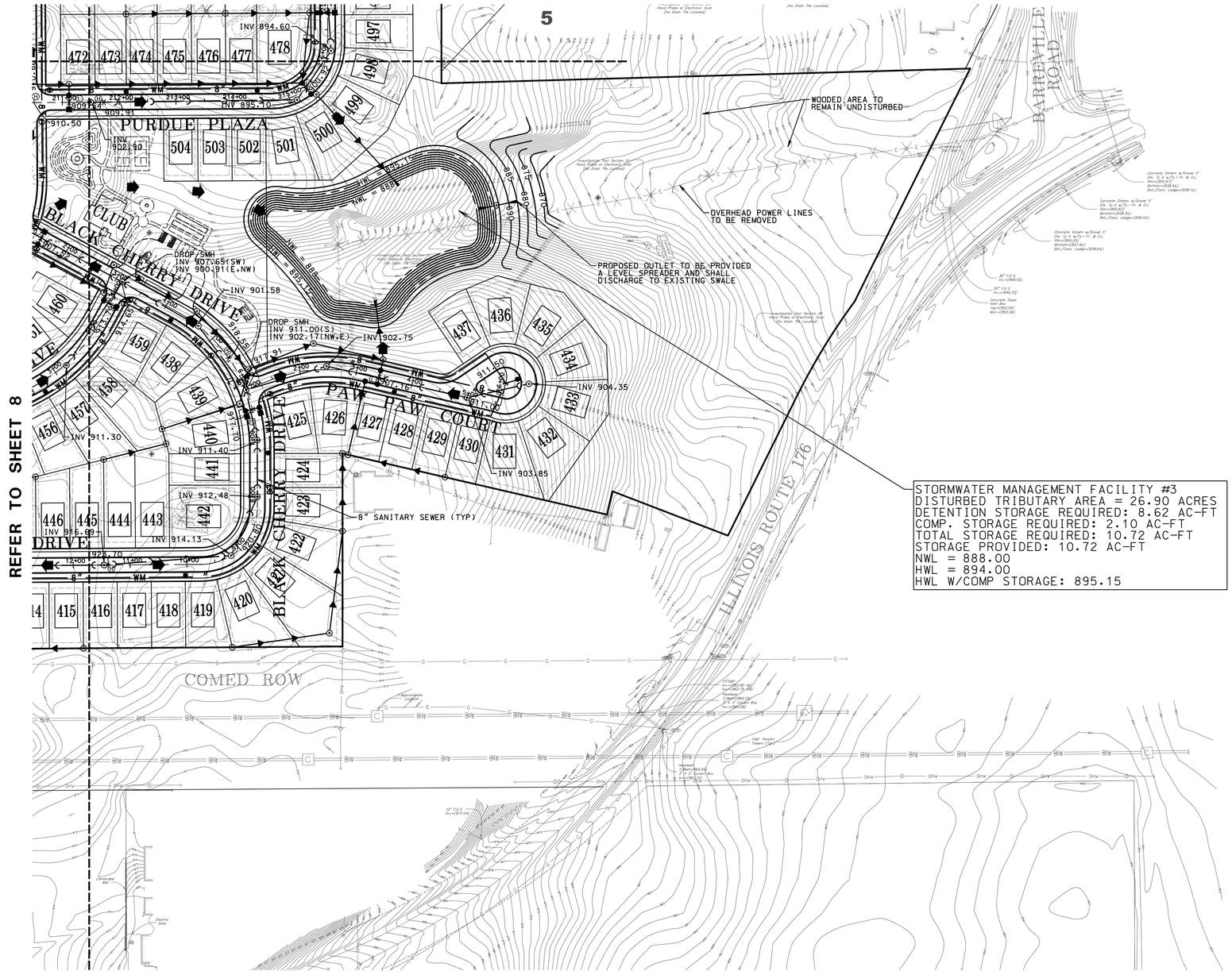
SHEET 8 OF 10
PROJECT NUMBER: 3144

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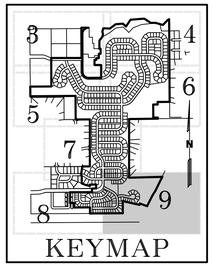
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REFER TO SHEET 7

REFER TO SHEET 8



STORMWATER MANAGEMENT FACILITY #3
DISTURBED TRIBUTARY AREA = 26.90 ACRES
DETENTION STORAGE REQUIRED: 8.62 AC-FT
COMP. STORAGE REQUIRED: 2.10 AC-FT
TOTAL STORAGE REQUIRED: 10.72 AC-FT
STORAGE PROVIDED: 10.72 AC-FT
NWL = 888.00
HWL = 894.00
HWL W/COMP STORAGE: 895.15



N

SCALE 1" - 100'
0 100 200

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DATE	DESCRIPTION OF REVISION	BY

DESIGNED	MTL
DRAWN	DWP
APPROVED	AJM
DATE	01/26/2018
SCALE	1" = 100'

PLAN - SOUTHEAST
WOODLORE ESTATES
CRYSTAL LAKE, ILLINOIS

SHEET 9 OF 10

PROJECT NUMBER: 3144

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ILLINOIS FIRM LICENSE 184-002694

GE-02a

GENERAL SITE-WORK:

1. Pre-Construction meeting shall be conducted with City Staff and all Contractors prior to commencing any grading or underground utility construction activities (schedule meeting with the Community Development Department at 815-356-3605).
2. 24-hour Emergency contact numbers shall be provided to City Staff at the Pre-Construction meeting.
3. Working hours shall be limited to the hours of 7:00 a.m. and 7:00 p.m. on weekdays only (except in cases of emergency). Non-emergency work on weekends or holidays is not permitted per City Code except under written permission from the City Engineer. The owner is responsible for the City Inspector cost of overtime inspection beyond the normal eight (8) hour day, including weekends and holidays.
4. Public/private streets shall be kept free of dirt and debris with regular cleaning, sweeping, and scraping conducted by the Contractor. Junk and debris shall not be allowed to accumulate, blow, or scatter onto streets or adjacent properties.
5. JULIE shall be contacted for utility locations on-site and in the adjacent rights-of-way.
6. Contractor shall provide and maintain fencing, barricades, traffic control signs, and other safeguarding measures during the course of all work to protect the public from the construction operations.
7. Maintain access to adjacent streets during construction. No closing of streets unless approval is first obtained from the agency with jurisdiction (City of Crystal Lake, McHenry County Department of Transportation, Illinois Department of Transportation, etc).
8. Any damage to public right-of-way, public utilities, streets, curb, etc. shall be repaired/replaced as soon as possible and as directed by the City Engineer.
9. The contractor shall give the City of Crystal Lake, Illinois Department of Transportation, and any other governmental agency having jurisdiction, at least two (2) working days notice excluding Saturday and Sunday prior to the initiation of any phase of construction. Contractor shall immediately notify if construction has ceased and renew the two (2) working day notification thereafter.
10. The Contractor shall be responsible for obtaining all required permits for construction prior to commencement along or across existing streets or highways. The Contractor shall make arrangements for the proper bracing, shoring and other protection of all roadways before construction begins.

GRADING:

1. The grading and construction of the site improvements shall not cause ponding of storm sewer water. All areas adjacent to these improvements shall be graded to allow positive drainage.
2. The proposed grading elevations shown on the plans are finished grade. A minimum of six (6) inches of topsoil is to be placed before finished grade elevations are achieved.
3. Embankment material within parkway and open space areas shall be compacted to a minimum of ninety percent (90%) of maximum density in accordance with ASTM Specification D-1557 (modified proctor method), or to such other density as may be determined appropriate by the soils engineer.
4. All subgrade material shall have a minimum CBR (California Bearing Ratio) of 3.0 as determined by the soils engineer, or base replacement and pavement design revisions shall be provided which are adequate to obtain equivalent pavement strength.
5. Proposed pavement areas, building pads, driveways and sidewalks and yard/open space areas shall be excavated or filled to plus or minus 0.1 foot of design subgrade elevations by the Contractor.
6. Any borrow pit locations shall be identified by the Contractor on a copy of the approved site plans and forwarded to the Engineering Division at least 24-hours prior to excavation. Provide backfill compaction reports from a geotechnical engineer and as-built plans to the Engineering Division for any borrow pit area.
7. Backfill shall be monitored by a geotechnical engineer on-site with compaction reports forwarded to the Engineering Division for review.
8. Water truck shall be on-site at all times during mass-grading operations and be available as needed for the purposes of dust control or at the request of City Staff.
9. Use of City fire hydrants is not allowed unless approved (separate from this permit) by the Public Works Department and a hydrant meter and RPZ is obtained from the City of Crystal Lake Water Division (815-356-3614). Only the City of Crystal Lake Water Division may operate valves and hydrants.

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	STANDARD NOTES AND SPECIFICATIONS	GE-02a	City of Crystal Lake Illinois
2.		Date: 01/30/15	
3.		Drawn DD / Checked AW	
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GE-02b

TOPSOIL STOCKPILING:

1. Location of any on-site topsoil stockpiles shall be identified on the approved plans with silt fence installed around the perimeter of the stockpile.
2. Topsoil stockpiled for future use shall be relatively free from large roots, sticks, weeds, brush, stones larger than one (1) inch diameter, or other litter and waste products including other extraneous materials not conducive to plant growth.
3. Topsoil shall be stockpiled in sequence to eliminate any re-handling or double movements by the Contractor. Failure to properly sequence the stockpiling operations shall not constitute a claim for additional compensation. No material shall be stockpiled in front yards, in utility easements, or in the right-of-way lines.
4. If a stockpile is to remain in place for more than (14) calendar days, it is required that the stockpile meet the requirements as outlined in section 595 of the City Code.

UNDERGROUND UTILITY:

1. The Contractor shall coordinate water main, water service, sanitary and storm sewer inspections and testing with the Community Development at least 24- hours in advance
2. All main line sanitary shall be cleaned and televised (provide DVD to the City's Engineering Division).
3. All manhole or valve covers shall be imprinted "City of Crystal Lake Sanitary", or "City of Crystal Lake Storm", or "City of Crystal Lake Water" as directed by the City.
4. Reference the latest edition of the Standard Specifications for Water and Sewer Main Construction in Illinois.
5. Existing manholes to be circular cored and booted.

EROSION CONTROL:

1. All specified erosion control measures shall be installed and maintained per the requirements of the Crystal Lake Stormwater Ordinance in accordance with the active NPDES permit.
2. All slopes 4:1 or steeper shall be sodded or blanketed immediately after mass earthwork.
3. All overland flow routes to be stabilized by sod or blanket.
4. Erosion control measures to be inspected and approved by City Engineering Division prior to additional work on site.
5. Continuous monitoring of erosion control measures is required. Maintain records of weekly reports per the City of Crystal Lake Stormwater Ordinance.
6. The Contractor shall implement any additional erosion control measures deemed necessary by the City per the standards of the City Of Crystal Lake Stormwater Ordinance.
7. All storm sewer catch basins, sumps and/or retention basins provided are to be cleaned at the end of construction of the project prior to final acceptance. Cleaning may also be required during the course of the construction of the project if it is determined that the silt and debris traps are not properly functioning and their performance is impaired.
8. Rip-rap material RR 2 (6") - RR4 (18") shall be in accordance with Article 281 and grouted in place according to Article 601 of the IDOT Standard Specifications.
9. Projects of 1 Acre or greater must obtain an NPDES permit prior to commencement of any construction activity.

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	STANDARD NOTES AND SPECIFICATIONS	GE-02b	City of Crystal Lake Illinois
2.		Date: 01/30/15	
3.		Drawn DD / Checked AW	
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GE-02c

SANITARY SEWER:

1. Non-shear stainless steel couplings shall be used when connecting sewer pipes of dissimilar materials and pipes with no hub joints. When connecting to an existing sanitary sewer by means other than an existing wye or manhole, contractor shall use a Sewer-Tap and hub-wye or hub-tee saddle.
2. Unless an alternate method is approved, water stop gaskets shall be provided at all sanitary sewer manhole connections. Type and manufacturer to be approved by the City.
3. PVC plastic sewer pipe and fittings of sizes 4-inch through 15-inch shall conform to the latest revised specification requirements of ASTM D3034 for type PSM polyvinyl chloride (PVC) sewer pipe and fittings of minimum wall thickness SDR 35.
4. Joints shall be either the solvent weld type conforming to the latest revised specification requirements of ASTM D2564 and ASTM D2855, or elastomeric gasket type conforming to the latest revised specification requirements of ASTM D1869 and ASTM D3212.
5. A thicker walled pipe such as SDR 26 may be specified by the engineer depending on design and/or field conditions.
6. PVC plastic sewer pipe and fittings of sizes 18-inch through 36-inch shall conform to the latest revised specification requirements of ASTM F679 or polyvinyl chloride (PVC) large diameter ribbed gravity sewer pipe and fittings, with integral bell gasketed joints and elastomeric gaskets to form a watertight seal conforming to the latest revised specification requirements of ASTM F477 or ASTM D3212.
7. Pipe and fittings shall be the products of one approved manufacturer only, and there shall not be any mixing of pipe and fittings of different manufacturers between manholes.
8. The handling and installation of pipe, assembly or joints, and manhole connections shall be in accordance with the manufacturer's recommendations.
9. Gasket-type watertight collars consist of a neoprene collar and a stainless steel band or other approved manhole watertight collars shall be installed wherever the pipe passes through the manhole walls to provide a watertight joint to prohibit infiltration into the sewer system.
10. PVC pipe shall be installed in accordance with the latest revised specification requirements of ASTM D2321 using either compacted class I or class II granular embedment materials for bedding, haunching and initial backfill of 12 inches over the top of pipe to provide the necessary support for the pipe so that the maximum deflection does not exceed five percent of the pipe's original internal diameter.
11. The Contractor shall provide the necessary tools and equipment and perform the work necessary to test the deflection in the initial 1,200 feet of installed sewer and not less than ten percent (10%) of the remainder of the sewer project at random locations selected by the engineers no sooner than 30 days after backfilling has been completed. In the event that deflection exceeds the maximum limit of five percent (5%), the Contractor shall test all other new flexible pipe for deflection. Deflection shall be tested by use of either a mandrel or rigid ball having a diameter equal to ninety-five percent (95%) of the inside diameter of the pipe, and the test shall be performed without using mechanical pulling devices. Wherever the deflection limitation is exceeded, the contractor shall uncover the pipe, carefully replace compacted embedment and backfill material, and retest for deflection.
12. The Contractor shall subject all sanitary sewers, including service lines, to an air test. Allowable infiltration shall not exceed 100 gallons per inch diameter of pipe per mile per day.

    The Contractor shall also televise all public sanitary sewers. Televising of sanitary sewer, cost for televising, and testing shall be the responsibility of the Contractor.
13. Cast Iron Soil Pipe: service weight cast iron soil pipe and fittings conforming C.I.S.P.I. Specification HS-67 with compression type rubber gasket joints conforming to ASTM specification C564, or other suitable materials approved by the City Engineer.

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	STANDARD NOTES AND SPECIFICATIONS	GE-02c	City of Crystal Lake Illinois
2.		Date: 01/30/15	
3.		Drawn DD / Checked AW	
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GE-02d

WATER MAIN:

1. Water main shall be Ductile Iron or Molecularly Oriented Polyvinyl Chloride (PVCO).
   a) Ductile Iron water main shall be Class 52 conforming to ANSI/AWWA C151/A21.51-09.
   b) Gaskets and cast iron fittings shall conform to ANSI/AWWA C111/A21.11 and ANSI/AWWA C110/A21.10 respectively.
   c) PVCO - See City Detail UW-12 and UW-13.
2. Thrust blocking or Mega-Lug or pre-approved equal shall be installed on water mains at all bends, tees, elbows, etc. except as noted below.
3. Thrust blocks not permitted with 45 degree vertical bends in water main (these shall be restrained with Mega-Lug or pre-approved equal.
4. When specified, ductile iron pipe shall be encased in polyethylene and shall conform with ANSI/AWWA C105/A21.10 - 10 and ASTM A674-10.
5. Minimum cover from finished grade to top of water main shall be six (6) feet; Maximum cover shall be eight (8) feet.
6. Water Main Taps: An Illinois licensed plumber is required for any water main tap.
7. All water mains shall be subjected to a pressure test and a separate leakage test at system pressure for 24 hours by the Contractor. Hydrostatic pressure test and leakage test shall be based on 125 PSI for two (2) hours. Water mains shall be chlorinated in accordance with the Standard Specifications.
8. The Underground Contractor shall consider incidental to the contract any chlorination and testing of existing water main where connections to and conclusion of such mains is indicated on the drawing.

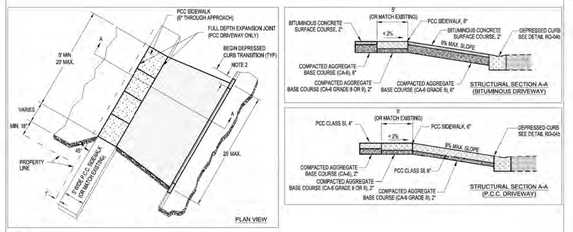
PAVING:

1. All subgrades and bases shall be proof-rolled and approved by the Engineering Division prior to base or binder installation.
2. Subgrade and proposed pavements shall be finished by the Excavation Contractor to within 0.1 foot plus or minus, of plan elevation.
3. The Paving Contractor shall ensure that the subgrade has been properly prepared and that the finished top of subgrade elevation has been graded within the tolerances allowed in these specifications. Unless the Paving Contractor advises the owner and engineer in writing prior to fine grading for base course construction, it is understood that the Contractor has approved and accepts responsibility for the subgrade.
4. For the purpose of providing handicap accessibility and complying with the American Disability Act and City Standards, curbs shall be depressed at locations where public walks or pedestrian paths intersect curb lines at street intersections and other locations as directed.
5. ½ inch thick premolded fiber expansion joints with two (2) No. 4 plain round steel dowel bars shall be installed at designated intervals and at all P.C., P.T., curb returns and at the end of each pour. Alternate ends of the dowel bars shall be greased and fitted with metal expansion tubes.
6. ½ inch thick fiber expansion joints shall be used in every case where the sidewalk coincides with the curb and gutter. Contraction joints shall be saw cut at designated intervals in the curb. The cost of these joints shall be considered as incidental to the cost of the contract.
7. All poured in place concrete curb and gutter shall incorporate two (2) No. 4 reinforcing bars installed wherever the curb and gutter crosses utility service lines, the cost of which shall be considered incidental to the cost of concrete curb and gutter.
8. Sidewalks (where required) shall be of the thickness and dimensions as shown in the construction plans. All sidewalk concrete shall be a minimum of 6:1 bag mix (or IDOT class SI concrete) and shall develop a minimum of 3,500 psi compressive strength at fourteen (14) days. Contraction joints shall be set at five (5) foot centers, and cow-hall inch (½ inch) premolded fiber expansion joints at fifty (50) foot centers and where the sidewalk meets the curb or another sidewalk, or at the end of each pour. All sidewalks constructed over utility trenches and/or abutting driveway aprons shall be reinforced with three (3) No. 4 reinforcing bars (10 foot minimum length).

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	STANDARD NOTES AND SPECIFICATIONS	GE-02d	City of Crystal Lake Illinois
2.		Date: 01/30/15	
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RD-01b



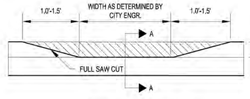
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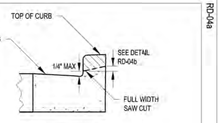
1. FOR THICKNESS OF PAVEMENT "T", VERTICAL THICKNESS OF THE GUTTER FLAG SHALL BE A MINIMUM OF 9 INCHES. FOR HMA BASE COURSE PAVEMENT SECTIONS THE GUTTER FLAG SHALL BE SAME THICKNESS AS PAVEMENT STRUCTURE.
2. TRANSITION FROM FULL CURB TO DEPRESSED CURB IN 1 TO 1.5 LINEAL FEET. ALSO, THE DRIVEWAY SHALL BE NO LESS THAN 3/4 OF THE DEPRESSION.
3. DRIVEWAY APPROACH SHALL MEET CURB AND GUTTER AT A POINT BETWEEN FULL CURB AND ONE-HALF CURB HEIGHT.
4. DRIVEWAY FLARE SHALL BE SYMMETRIC ABOUT THE DRIVEWAY CENTERLINE, AS MEASURED AT THE PROPERTY LINE, UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.

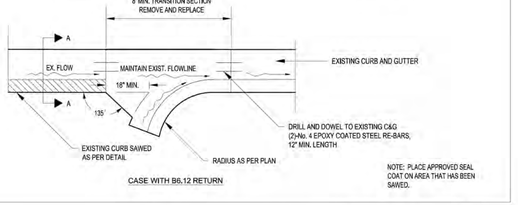
Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	DRIVEWAY: RESIDENTIAL APPROACH	RD-01b	City of Crystal Lake Illinois
2.		Date: 01/30/15	
3.		Drawn DD / Checked AW	
4.			

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RD-04a







NOTE: PLACE APPROVED SEAL COAT ON AREA THAT HAS BEEN SAWED.

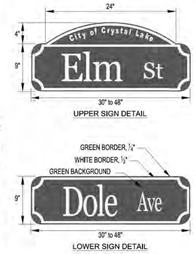
Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	DEPRESSED CURB: ENTRANCE BY SAWING	RD-04a	City of Crystal Lake Illinois
2.		Date: 01/30/15	
3.		Drawn DD / Checked AW	
4.			

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TR-01

NOTES:

1. ALL SIGNS AND POSTS ARE TO BE FURNISHED BY THE DEVELOPER. THE DEVELOPER SHALL INSTALL ALL TRAFFIC CONTROL SIGNS, INCLUDING STREET NAME SIGNS, AND PROVIDE THE CITY WITH TWO (2) SPARE PLATES PER STREET NAME PER INTERSECTION.
2. STREET NAME SIGNS
   FOR MOUNTING ON ORNAMENTAL OR DECORATIVE STREET LIGHT POLES:
   - JUMBO WING BRACKETS OR EQUIVALENT SHALL BE USED, WITH EXTENSIONS IF NEEDED, FOR FLAT ALUMINUM SIGN BLANKS. TO ACCOMMODATE STREET NAME SIGNS FROM 30" TO 54" IN LENGTH
   - ⅜" x 0.030" STAINLESS STEEL BANDING, BAND-IT 1" STAINLESS STEEL "VALUE CLIPS", BAND-IT BRACKET DX04 STAINLESS STEEL "U" BRACKETS, TWO (2) ⅜" x 1½" - 16 SIGN BOLTS, AND STREET NAME PLATES.
   - SINGLE STREET NAME SIGNS INSTALLATION USING THE JUMBO WING BRACKETS SHALL HAVE SIGN WITH BONNET.
3. SIGNS AND POSTS SHALL BE INSTALLED PRIOR TO OCCUPANCY AND SHALL BE INSTALLED ACCORDING TO THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
   A. SIGN PANELS (4 PER POST) SHALL BE IDOT STANDARD 0.080" ALUMINUM BLANKS, 9" HIGH BY 30", 36", 42", 48" OR 54" IN LENGTH WITH A 1" RADIUS ON ALL CORNERS.
   B. SIGN FACE MATERIAL SHALL BE 3M DG3 REFLECTORIZED SHEETING (ASTM PROPOSED TYPE 11, ILLINOIS TYPE ZZ) WITH WHITE LETTERING ON A GREEN BACKFIELD.
   C. A 1½" GREEN BORDER SHALL ENCOMPASS THE FRAME OF THE SIGN WITH A ½" WHITE BORDER ENCOMPASSING THE MAIN SIGN (MUTCD, 2003 EDITION, SECTION 2A-15, PAGE 2A-8 "SIGN BORDERS").
   D. FONT STYLE IS GEORGIA REGULAR.
   E. MAIN LETTERING SHALL BE 6" HIGH AND ALL ABBREVIATIONS (STREET, AVENUE, ROAD, ETC.) SHALL BE 3" HIGH (MUTCD, 2003 EDITION, SECTION 2D-38, PAGE 2D-17 "STREET NAME SIGN"). LETTERING SHALL UTILIZE BOTH UPPER AND LOWER CASE LETTERS.
   F. THE TOP SIGN SHALL HAVE A BONNET THAT IS 24" LONG x 4" HIGH INCORPORATED WITH THE WORDING "CITY OF CRYSTAL LAKE" USING 2" HIGH LETTERING ARCHED IN THE BONNET AREA.
4. REFER TO DETAIL TR-03 FOR POST SPECIFICATIONS.
5. FOR MOUNTING ON A 2⅜" X 10' O.D. BLACK POWDERED COATED PIPE:
   A. POSTS SHALL BE 2⅜" X 10' 0.095" THICK WALL, HEAVY DUTY GALVANIZED PRIME COAT AND A SURFACE COAT OF HIGH GLOSS BLACK POWDER COAT.
   B. HARDWARE SHALL INCLUDE THE E480 BRACKET FOR SIGN INSTALLATION ON 2⅜" O.D. PIPE TO ACCOMMODATE TWO (2) 9" AND TWO (2) 13" STREET SIGN BLANKS.
   C. STREET SIGNS INSTALLED ON THE 2⅜" O.D ROUND POST SHALL BE A FOUR (4) SIGN INSTALLATION. THE PRIMARY STREET SHALL BE THE TOP SIGN AND INCLUDE THE BONNET AND THE SECONDARY STREET SHALL BE LOWER SIGN WITHOUT THE BONNET.



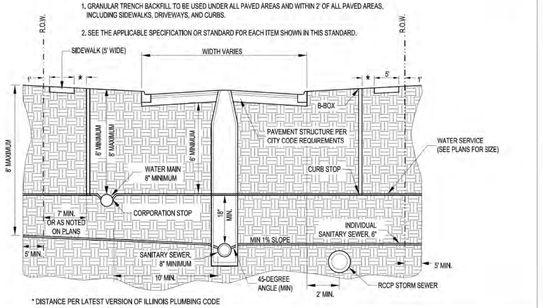
Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	STREET NAME SIGNS	TR-01	City of Crystal Lake Illinois
2.		Date: 04/15/2008	
3.		Drawn EM / Checked AW	
4.			

L:\ENGINEERING AND BUILDING\ENGINEERING DETAILS AND STANDARDS\

UG-01

NOTES:

1. GRANULAR TRENCH BACKFILL TO BE USED UNDER ALL PAVED AREAS AND WITHIN 2' OF ALL PAVED AREAS, INCLUDING SIDEWALKS, DRIVEWAYS, AND CURBS.
2. SEE THE APPLICABLE SPECIFICATION OR STANDARD FOR EACH ITEM SHOWN IN THIS STANDARD.

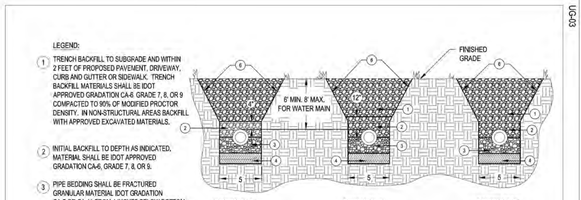


* DISTANCE PER LATEST VERSION OF ILLINOIS PLUMBING CODE

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	TYPICAL STREET AND UTILITY LOCATIONS	UG-01	City of Crystal Lake Illinois
2.		Date: 05/28/2015	
3.		Drawn JH / Checked AW	
4.			

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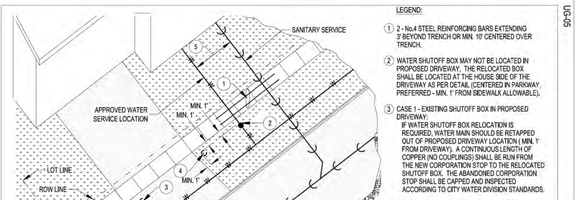
UG-03



Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	TYPICAL TRENCH CROSS SECTION	UG-03	City of Crystal Lake Illinois
2.		Date: 05/29/2015	
3.		Drawn JH / Checked AW	
4.			

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UG-05



LEGEND:

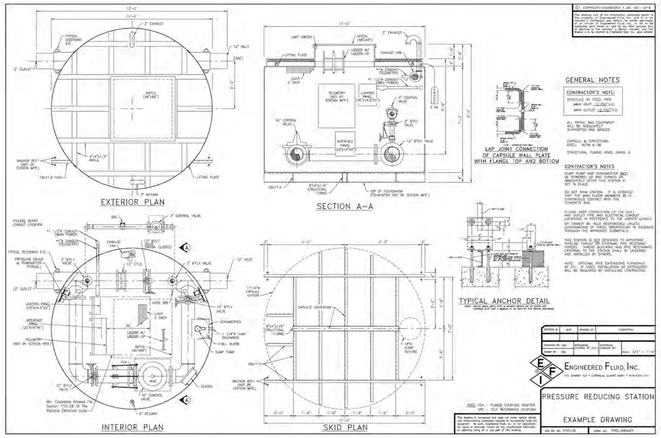
1. 2 - No.4 STEEL REINFORCING BARS EXTENDING 3' BEYOND TRENCH OR MIN. 10' CENTERED OVER TRENCH.
2. WATER SHUTOFF BOX MAY NOT BE LOCATED IN PROPOSED DRIVEWAY. THE RELOCATED BOX SHALL BE LOCATED AT THE HOUSE SIDE OF THE DRIVEWAY AS PER DETAIL (CENTERED IN PARKWAY, PREFERRED - MIN. 1' FROM SIDEWALK ALLOWABLE).
3. CASE 1 - EXISTING SHUTOFF BOX IN PROPOSED DRIVEWAY:
   IF WATER SHUTOFF BOX RELOCATION IS REQUIRED, WATER MAIN SHOULD BE RETAPPED OUT OF PROPOSED DRIVEWAY LOCATION (MIN. 1' FROM DRIVEWAY). A CONTINUOUS LENGTH OF COPPER (NO COUPLINGS) SHALL BE RUN FROM THE NEW CORPORATION STOP TO THE RELOCATED SHUTOFF BOX. THE ABANDONED CORPORATION STOP SHALL BE CAPPED AND INSPECTED ACCORDING TO CITY WATER DIVISION STANDARDS.
4. CASE 2 - EXISTING SHUTOFF BOX OUTSIDE PROPOSED DRIVEWAY:
   IF WATER SHUTOFF BOX RELOCATION IS REQUIRED, THE EXISTING CORPORATION STOP MAY REMAIN. A CONTINUOUS LENGTH OF COPPER (NO COUPLINGS) SHALL BE RUN FROM THE CORPORATION STOP TO THE RELOCATED SHUTOFF BOX. RELOCATED BOX SHALL BE LOCATED MIN. 1' FROM DRIVEWAY.
5. 10' WATER AND SANITARY SERVICE SEPARATION OR REFER TO COMMON TRENCH DETAIL.

NOTES:

1. FOR FAR SIDE SERVICES CONSULT THE CITY ENGINEER.

Revised:	Drawing Name	Drawing Number	
1. 06/12/2015	TYPICAL WATER AND SANITARY SERVICE LOCATION	UG-05	City of Crystal Lake Illinois
2.		Date: 04/16/2007	
3.		Drawn EM / Checked AW	
4.			

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NOTES:

THE ABOVE LIST IS ONLY A REPRESENTATIVE SAMPLE OF THE ANTICIPATED FINAL CONSTRUCTION DETAILS AND SPECIFICATIONS.

THE ABOVE DETAILS ARE TO PROVIDE CONTEXT TO THE DIRECTION OF FINAL DESIGN AND THE STATNDARDS WHICH WILL BE MET WITHIN THE FINAL ENGINEERING PLANS.

THE PRESSURE REDUCING VALVE/STATION WILL NEED TO BE FULLY DESIGNED WITH FINAL ENGINEERING, THE DETAIL TO THE LEFT IS ONLY A SAMPLE PLAN FOR THE TWO PROPOSED VALVES ONSITE.

1/29/2018 10:56:42 AM
M:\2014 Engineering\Woodlore Preliminary\10-Details.pit

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(847)696-1400
www.mackieconsult.com

CLIENT:
CalAtlantic Homes
1141 East Main Street, Suite 108
East Dundee, IL 60118
Phone: 224-293-3100 Fax: 224-293-3101

DATE	DESCRIPTION OF REVISION	BY

DESIGNED	MTL
DRAWN	DWP
APPROVED	AJM
DATE	01/26/2018
SCALE	N.T.S.

GENERAL CONSTRUCTION DETAILS
WOODLORE ESTATES
CRYSTAL LAKE, ILLINOIS

SHEET 10 OF 10

PROJECT NUMBER: 3144

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ILLINOIS FIRM LICENSE 184-002694

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Transportation

Civil

Construction

Environmental

Water Resources

Structural

Appraisal

Technical Memorandum

Date: January 26, 2018

To: Ms. Abigail Wilgreen, P.E.
City Engineer
City of Crystal Lake

From: James R. Woods, P.E., PTOE
Brian R. DeSalle, P.E., PTOE
Civiltech Engineering, Inc.

Re: Proposed Woodlore Estates Residential Development
Traffic Impact Study

Civiltech Engineering, Inc. is retained by CalAtlantic Homes through the City of Crystal Lake to perform a traffic impact study (TIS) for an approximately 60-acre residential development located east of IL Route 31 south of Brighton Lane and north of IL Route 176 in Crystal Lake, Illinois. The proposed development will consist of 421 single-family homes and 68 townhomes. The primary access location to the development will be provided from IL Route 31 at its intersection with River Birch Boulevard. Additional access locations for the development will be at IL Route 176 and Carpathian Drive and along IL Route 31 at Drake Drive and Brighton Lane. Internal site roadways will connect to Drake Drive and Brighton Lane to allow access to and from those roadways.

Exhibit A is a map showing the location of the proposed site in relation to the area roadway system and **Exhibit B** is an aerial view of the site area. See **Exhibit C** for a proposed site plan.

The purpose of this study is to examine existing traffic conditions adjacent to the proposed site, assess the impact that the proposed development will have on traffic conditions, and determine if any roadway improvements are necessary to accommodate traffic generated by the proposed residential development. This memorandum contains the following:

- Description of the study area and proposed development
- A trip generation, distribution and assignment analysis
- Determination of background traffic conditions
- An analysis of traffic conditions on the adjacent roadway network with site-generated traffic added to background traffic
- An analysis of the proposed site access intersections
- A brief analysis of proposed internal site circulation
- Conclusions and recommendations

I. EXISTING CONDITIONS

The proposed development is located in southeast McHenry County in the City of Crystal Lake. The existing land uses within the study area are primarily residential and vacant/agricultural, although some retail/commercial exists near the intersection of IL Route 31 and IL Route 176, and some small office buildings are located at intervals along IL Route 31.

A. Existing Roadway System Characteristics

IL Route 31 is a two-lane major arterial. It is one of the primary north-south routes that connects eastern McHenry County with the regional roadway system. While much of Route 31 has been widened to provide two through lanes in each direction, the section adjacent to the subject property current consists of only a single lane in each direction. The 2014 improvement of the IL Route 31/IL Route 176 intersection included widening IL Route 31 to four lanes through the intersection, but that improvement ends approximately one-quarter mile south of River Birch Boulevard.

The roadway is under the jurisdiction of the Illinois Department of Transportation (IDOT), and is designated as an IDOT Strategic Regional Arterial (SRA) between James R. Rakow Road and U.S. Route 12 in McHenry County. IL Route 31 has a posted speed limit of 40 mph at IL Route 176, 45 mph between IL Route 176 and Drake Drive, and 55 mph north of Drake Drive. It carries an average daily traffic (ADT) volume of about 26,000 to 28,000 veh/day north of IL Route 176, and about 36,000 veh/day south of IL Route 176 within the project area.

At its T-intersection with River Birch Boulevard, IL Route 31 has one through lane in each direction and one exclusive northbound to eastbound right turn lane. The current northbound right turn lane originally provided access to the medical office development north of River Birch Boulevard, however, the turn bay length also accommodates access to River Birch. Southbound lefts onto River Birch Boulevard occur from the southbound through lane. At Drake Drive, IL Route 31 provides one shared through/left-turn lane and one exclusive right-turn lane on both approaches. At its T-intersection with Brighton Lane, an exclusive southbound left-turn lane and northbound right-turn lane are provided. The IL Route 31/IL Route 176 improvement widened both roadways to a four-lane cross-section with dual left turn lanes and separate right turn lanes at that intersection. The improvement also eliminated a fifth leg of the intersection by constructing a cul-de-sac on Terra Cotta Avenue to the east of the intersection.

A two-lane roadway approaches its desirable capacity when the daily traffic numbers reach 15,000 to 16,000 vehicles per day. This indicates that this section of IL Route 31 adjacent to the development should be evaluated for a long-term regional capacity improvement. As such, IDOT is currently in the process of completing a Phase I study for IL Route 31 between IL Route 176 and IL Route 120. The preferred alternative (based on the Draft Environmental Assessment dated February 2017) widens the existing two-lane, undivided roadway to a four-lane roadway with a 28- to 30-foot wide barrier median. Design approval is anticipated in 2018, however, the current IDOT five-year highway improvement program only includes Phase II design. Construction is not in the current multi-year plan through 2023.

IL Route 176 (Terra Cotta Avenue) is a two-lane major east-west arterial used for regional travel due to a lack of other east-west facilities in the area. The roadway is under the jurisdiction of IDOT, and is designated as an IDOT SRA between IL Route 23 in McHenry County and U.S. Route 12 in Lake County. IL Route 176 has a posted speed limit of 40 mph and carries an average daily traffic (ADT) volume of 17,500 to 18,500 veh/day.

At its intersection with IL Route 31, the 2014 improvement widened IL Route 176 to a four-lane cross-section and provided dual left-turn lanes and an exclusive right-turn lane on both approaches. A 12-foot wide striped median is generally provided west of IL Route 31. The roadway does not have a continuous median east of IL Route 31 in the project area.

IL Route 176 is also approaching the desirable capacity of a two-lane roadway, and IDOT has had a Phase I study programmed in its multi-year highway plan for IL Route 176 for the past 11 years, including the most current plan. The Phase I study is intended to investigate capacity improvement needs between U.S. Route 14 and IL Route 31, however, it is unclear when any potential corridor improvements may be studied, designed, and constructed.

River Birch Boulevard is a partially-completed local street located between Drake Drive and Ray Street that is planned to be completed and serve as the primary entrance to the site from IL Route 31. Currently, the eastbound lanes are barricaded off at IL Route 31, and the roadway is only used for maintenance on the City water tower located within the proposed site. The westbound side of the boulevard is paved, roughly up to the eastern IL Route 31 right-of-way line. There is a grassed gap between there and the eastern edge of IL Route 31 in the westbound direction. To the east, River Birch provides two approximately 20-foot wide paved, unstriped roadways separated by an approximately 30-foot landscaped barrier median. This roadway was constructed as part of a previously approved development plan for the site in 2007, and is described as roadway "Q" in the 2006 TIS for that development.

The 2006 TIS recommended that exclusive left and right turn lanes be constructed on IL Route 31 for the first phase of that development. It stated that subsequent phases would likely warrant a traffic signal at this intersection. In order to consider a traffic signal, the 2006 TIS stated that IDOT would require that two through lanes in each direction be constructed and the center median be built to match the proposed (now completed) IL Route 31/IL Route 176 intersection improvement cross-section. The east leg/westbound approach to IL Route 31 was planned to provide one right turn lane, one through lane and one left turn lane.

As part of the current site plan, the intersection of River Birch Boulevard and IL Route 31 will be completed. This is also reflected in the Draft Environmental Assessment for the IL Route 31 Phase I Study, with stop-sign control recommended in the report for the River Birch Boulevard approach. The concept geometrics in the Environmental Assessment also indicate that the existing commercial driveway (former ambulatory facility) immediately north of River Birch Boulevard on the east side of the roadway would be removed and access to that parcel would be moved to River Birch instead of IL Route 31.

Smith Road is a two-lane collector roadway that serves residential areas east of IL Route 31 between IL Route 176 and Meandering Way. At its signalized "T"-intersection with IL Route 176, separate left and right turn lanes are provided on the northbound approach, with exclusive turn lanes provided onto Smith Road on the IL Route 176 approaches. The intersection is located approximately 700 feet east of the proposed IL Route 176/Carpathian Drive intersection that will provide access to the proposed site directly from IL Route 176. Smith Road carries an ADT of 1,000 veh/day and has a posted speed limit of 40 mph.

Drake Drive is a two-lane local street that serves a small subdivision of approximately 45 single-family residences, and is located approximately 1,000 feet north of River Birch Boulevard. At its intersection with IL Route 31, a single lane for all travel movements is provided on the east and west approaches, with a shared left/through lane and exclusive right-turn lanes provided on the IL Route 31 approaches. The west approach at the Drake Drive/IL Route 31 intersection serves as the driveway for the College Hill Professional Building. This

intersection is located at the top of a vertical crest in the IL Route 31 alignment, and field observations indicated potential sight distance challenges to the north for drivers waiting on the east Drake Drive approach due to the vertical curvature. Drake Drive has an existing roadway connection into the proposed site via Purdue Place. The connection was constructed as part of the 2007 development and is currently blocked off. The posted speed limit on Drake Drive is 25 mph.

Brighton Lane is a two-lane local street that serves The Springs health care center and The Fountains senior living development. Its "T"-intersection with IL Route 31 is located approximately three-quarters of a mile north of River Birch Boulevard and approximately 0.3-mile south of Half Mile Road. A single approach lane is provided on the Brighton Lane approach that is wide enough for stacking of left and right turning vehicles side-by-side. Exclusive southbound left-turn and northbound right-turn lanes are provided on IL Route 31 at the intersection. The posted speed limit on Brighton Lane is 20 mph.

Exhibit D shows the existing lane configurations and traffic control for the intersections within the study area.

B. Existing Traffic Conditions

In order to quantify current traffic conditions in the vicinity of the site, 24-hour turning movement traffic counts were conducted using Miovision Scout video cameras at the following three intersections:

- IL Route 31 at Drake Drive
- IL Route 31 at Brighton Lane
- IL Route 176 at Smith Road

The IL Route 31 counts were performed on Tuesday, November 29, 2016, and the IL Route 176 count was performed on Tuesday, January 16, 2018. The weekday morning peak hour of traffic occurs from 6:45 to 7:45 A.M. and the weekday evening peak hour occurs from 4:30 to 5:30 P.M. In addition to the Miovision counts, the City of Crystal Lake provided 24-hour traffic count data for the intersection of IL Route 31 and IL Route 176 that was collected on Wednesday, April 27, 2016. **Exhibit E** illustrates existing peak hour and daily traffic volumes within the study area.

IL Route 31 carries an average daily traffic (ADT) volume of 26,600 to 27,700 veh/day adjacent to the proposed site. This is much greater than the approximately 15,000-vpd maximum desirable capacity of a two-lane highway. The counts reveal that there is little directionality on IL Route 31, with approximately 45% of the total traffic during each of the two peak hours heading southbound and 55% heading northbound. Turns to and from the existing intersections at Drake Drive and Brighton Lane are very light. While the traffic count at IL Route 176 and Smith Road was performed in 2018 instead of 2016 like the other traffic counts, the peak hour volumes are very similar in magnitude to the 2016 counts at the IL Route 31/IL Route 176 intersection. Therefore, these newer counts have also been treated as 2016 existing counts as a conservative assumption.

II. TRAFFIC CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

In order to evaluate future traffic conditions in the surrounding area, it was necessary to determine the traffic characteristics of the proposed development, including estimating the directional distribution and volumes of traffic that it will generate.

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A. Proposed Development Plan

See **Exhibit C** for the proposed site plan, dated November 20, 2017. Based on the proposed plan, the site will have 421 single-family residential lots and 68 townhome lots. The townhomes are proposed to be located on the southern portion of the site closest to IL Route 31 with the single family lots located on the remainder of the site. The existing roadway network on the southern portion of the site that was constructed as part of the previous development in 2007 will be generally maintained with some modifications as part of the proposed development.

Access to the site is proposed to be provided via four access locations:

- River Birch Boulevard at IL Route 31 (Completion of existing intersection)
- Carpathian Drive at IL Route 176 (New roadway connection through ComEd right-of-way and parcels to the south per June 2013 access agreement)
- Drake Drive at IL Route 31 (Via connection to existing subdivision at Purdue Place)
- Brighton Lane at IL Route 31 (Via connection to Brighton Lane near The Springs health care center)

The main access roadway into the site is proposed to be at River Birch Boulevard located along IL Route 31 approximately one-third of a mile north of the intersection of Ray Street. River Birch Boulevard east of the intersection contains approximately 22 feet of pavement in each direction separated by a 30-foot wide landscaped median. The westbound approach to IL Route 31 widens to allow for separate lanes for left and right turning vehicles out of the site. The intersection is located along a relatively flat section of the IL Route 31 alignment, so it is anticipated that there will be no difficulty in providing sufficient sight distance at this location.

A secondary access location is a connection to IL Route 176 to the south via Carpathian Drive, which is to be a new two-lane collector roadway. In June 2013, the previous developer of the Woodlore property, Ryland Homes, entered into an access agreement with Riverbirch Crossing, LLC, which is the owner of the two parcels along IL Route 176 south of the ComEd easement and west of the Smith Road intersection. Per this agreement, the owner of the Woodlore property is granted easement for an access roadway between the Woodlore property and IL Route 176 through the Riverbirch Crossing parcels. See **Exhibit B** for the approximate easement location. Additionally, the first of the properties to be developed would be responsible for the roadway construction, which in this case will be CalAtlantic, as no development plans for the Riverbirch Crossing properties are currently proposed. Therefore, this access connection will be in place when the Woodlore Estates development is fully built.

A third access location for the site is to Drake Drive via Purdue Place within the existing subdivision north of River Birch Boulevard. This cross-access was constructed as part of the original 2007 development, but is blocked-off with barricades today. The proposed site plan opens this connection to allow residents to exit the development via Drake Drive onto IL Route 31, though we believe it is unlikely that any residents of the proposed development will use this connection to exit the site. It may be more likely that residents of the College Hill subdivision located along Drake Drive use the proposed street network to access either IL Route 31 at River Birch Boulevard or Il Route 176 at Carpathian Drive. The current site plan does not indicate any improvements to Drake Drive or its intersection with IL Route 31 as part of the proposed development.

The fourth access location is a connection to Brighton Lane as part of the proposed site roadway network. An internal collector street is planned to intersect Brighton Lane at or near the existing driveway for the Springs

health care center. The current site plan does not indicate any improvements to the Brighton Lane intersection with IL Route 31.

B. Background Traffic Growth

It is anticipated that the traffic volumes currently on the roadway network will increase while the proposed development is being constructed and throughout the time that the development reaches full occupancy. Based on 2040 traffic projections obtained from the Chicago Metropolitan Agency for Planning (CMAP) for the IL Route 31/IL Route 176 intersection, the ambient growth factor for the study area is 1.7 percent per year. This projected growth was applied based on a horizon year of time of construction plus five years resulting in an analysis year of 2023, assuming construction is started in 2018. These 2023 Background traffic volumes are shown in **Exhibit F**. Copies of the correspondence with CMAP are provided in **Appendix A**.

C. Estimate of Site-Generated Trip Distribution

The distribution of development-generated trips on the roadway system is a function of several variables. Because of the residential nature of the proposed development, and absence of a clear commuting pattern on IL Route 31 in this area, we have assumed that trips generated by the proposed site will generally follow the same magnitudes and regional patterns as existing traffic. **Exhibit G** shows the estimated Directional Distribution on the roadway network for vehicles destined to and from the site.

D. Estimated Site Traffic Generation

A Traffic Impact Study projects future traffic conditions and recommends methods to offset the impacts of the anticipated increase in traffic volumes due to land development. The volume of traffic generated by a development is based on the type of land use and the size of the development. At the core of a Traffic Impact Study are trip generation estimates. These estimates are typically completed with the aid of the publication *Trip Generation, 9th Edition*, published by the Institute of Transportation Engineers (ITE). *Trip Generation* provides average trip generation rates representing weighted averages of traffic counts and studies collected from various land uses throughout the United States and Canada since the 1960's. **Table 1** summarizes the peak hour traffic estimated to be generated by the development based on the ITE *Trip Generation* Manual.

Table 1. Trip Generation Analysis

Land Use	ITE Code	Units	Weekday			A.M. Peak Hour			P.M. Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
Single-Family Detached Housing	210	421	2,005	2,005	4,010	80	235	315	245	140	385
Residential Condominium/Townhouse	230	68	230	230	460	5	35	40	30	15	45
Total Site-Generated Trips			**2,235**	**2,235**	**4,470**	**85**	**270**	**355**	**275**	**155**	**430**

E. Assignment of Site-Generated Traffic to Access Points and Roadway Network

The vehicle trips estimated to be generated by the proposed development as shown in **Table 1** were assigned to the roadway network as shown on **Exhibit G**. No trips were assigned to the Drake Drive access due to the sight

distance limitations described previously. Due to the heavy traffic volumes along IL Route 31, it is anticipated that a majority of motorists that would normally turn left from River Birch Boulevard or Brighton Lane to travel south along IL Route 31 will instead use the proposed access onto IL Route 176 to turn right and then make an easier left turn at the IL Route 31/IL Route 176 signal.

The proposed development adds 355 vehicles to the roadway network during the A.M. peak hour and 430 vehicles during the P.M. peak hour. This is equivalent to about one new vehicle every 8 to 10 seconds being added to the roadway network during the peak hours. On a daily basis, the proposed development increases traffic on IL Route 31 by about 4 to 8 percent depending on location.

The estimated A.M. and P.M. peak hour site-generated traffic volumes were then added to the 2023 background traffic volumes to determine total traffic volumes for analysis. The background plus site-generated (i.e., total) traffic volumes are shown in **Exhibit H**.

III. TRAFFIC ANALYSIS

A. Preliminary Signal Warrant Analysis

Although a signal cannot be warranted based on future conditions, it is noted that the proposed development generates a moderate amount of traffic and that the traffic on IL Route 31 exceeds the desired level of traffic for a two-lane roadway. Therefore, preliminary signal warrant analyses were performed for the IL Route 31/River Birch Boulevard and the IL Route 31/Brighton Lane intersections for 2023 Total traffic conditions. The calculations for this preliminary warrant analyses are provided in **Appendix B**. Based on the criteria in the MUTCD, the following traffic signal warrants would be the most applicable to these intersections:

- Warrant 1, Eight Hour Volume, Condition B (Interruption of Continuous Traffic)
- Warrant 2, Four Hour Volume
- Warrant 3, Peak Hour Volume

Based on the volume exiting the site at both intersections during the A.M. peak hour, none of the three above warrants would be met at either intersection based on MUTCD criteria if only the Woodlore Estates development were considered. Additionally, IDOT has designated IL Route 31 as an SRA route, which favors mobility over local access. IDOT has thus restricted the criteria through which a traffic signal can be warranted on these routes. With the restricted criteria, Warrants 2 and 3 cannot be applied, and the traffic volume requirements to meet Warrant 1 are increased.

It should be noted that there are two parcels adjacent to IL Route 31 that would also be utilizing a potential traffic signal at both the IL Route 31/River Birch Boulevard and IL Route 31/Brighton Lane intersections. At River Birch Boulevard, the northern parcel is a vacant medical office building that is a candidate for redevelopment, and the southern parcel is vacant open land. Based on the most current City zoning map, the northern parcel is zoned Residential Estate, which allows for potential construction of additional homes, while the southern parcel is zoned B-2, which allows for a wide variety of commercial businesses, from strip centers to drive-thru pharmacies. At Brighton Lane, both of the parcels on either side of Brighton Lane are zoned B-2

If it is assumed that a specialty retail center of the size (15,000 sq. ft.) of the Woods of Crystal Lake (located to the south near Ray Street) is developed on any of the B-2 zoned parcels, the additional estimated minimum trips generated (55) during the highest eight traffic hours would provide the additional 50 to 60 trips that would

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satisfy the more restrictive SRA warrant for a traffic signal at either location. Without a traffic signal, the very heavy traffic volumes along IL Route 31 will likely make westbound turning movements at both intersections very difficult, especially left turns. Many motorists who would normally turn left at these intersections will divert to the site access along IL Route 176 to take advantage of the traffic signal at the IL Route 31/IL Route 176 intersection in order to complete their desired left turn onto southbound IL Route 31.

There is also a vacant parcel on the west side of IL Route 31 that would utilize a traffic signal at River Birch Boulevard if the access to the parcel is aligned with the River Birch alignment. One possibility is that the current end of Providence Lane to the west of the vacant parcel is extended to complete the fourth leg of the River Birch intersection. This may draw enough traffic from the developments to the west to also warrant a traffic signal in the future.

Considering all of the above factors, we suggest the following in regard to installation of traffic signals at either IL Route 31/River Birch Boulevard or IL Route 31/Brighton Lane:

- The developer should put aside funding in escrow for cost sharing of the installation of a traffic signal in either location if additional development or redevelopment on the adjacent parcels or on the west side of IL Route 31 at either intersection increases traffic such that the signal warrants are met under the SRA restrictions.

B. Auxiliary Turn Lane Evaluation

Each of the unsignalized intersections providing access to the proposed development were evaluated for the need to install exclusive left- and right-turn lanes based on the guidelines contained in Chapter 36, Section 3.01 of the *IDOT BDE Manual*. A summary of the geometric needs for each intersection based on these guidelines is provided in **Table 2**.

Table 2. Auxiliary Turn Lane Evaluation Summary (Chs. 36-3.01 and 46-3.04 of IDOT *BDE Manual*)

Intersection	Left Turn Lane Criteria (Fig. 36.3-D)				Right Turn Lane Criteria (Fig. 36-3AI)		
	Peak Turning Traffic Volumes			Turn Lane Needed?	Traffic Volumes (veh/hr)		Turn Lane Needed?
	Left Turn	Advancing	Opposing		Right Turn	Total Appr.	
IL Route 31 at River Birch Blvd.	80 (SB)	1,240 (SB)	1,455 (SB)	Yes (SB)	Modify Existing Right Turn Lane from Vacant Commercial Parcel		
IL Route 31 at Brighton Lane	Maintain Existing Left-Turn Lane				Maintain Existing Right-Turn Lane		
IL Route 176 at Carpathian Drive	15 (EB)	860 (EB)	860 (EB)	Yes (EB)	15 (WB)	875 (WB)	No (WB)

Based on the findings shown in Table 2, it is recommended that a southbound left turn lane be constructed on IL Route 31 at River Birch Boulevard and that the existing northbound right turn lane to the vacant medical office parcel be modified to provide northbound right turns onto River Birch Boulevard. On IL Route 176 at Carpathian Drive, it is recommended that an eastbound left turn lane be provided. While a westbound right turn lane is shown in preliminary engineering drawings submitted as part of the access agreement, the drawing also states that the final geometrics shall be determined upon IDOT coordination. Based on IDOT BDE guidelines, the right turn lane is not required based on the traffic generated by the Woodlore Estates development alone.

C. Intersection Capacity Analyses

Intersection capacity analyses were performed for the following intersections to evaluate exiting traffic operations at the intersection and to help evaluate the extent of the impacts of the proposed development on traffic operations:

- IL Route 31 at IL Route 176 (Existing Signal)
- IL Route 31 at River Birch Boulevard (Proposed Unsignalized)
- IL Route 31 at Drake Drive (Unsignalized)
- IL Route 31 at Brighton Lane (Unsignalized)
- IL Route 176 at Carpathian Drive (Proposed Unsignalized)
- IL Route 176 at Smith Road (Existing Signal)

Traffic analyses in this study were performed using the methodologies in the Transportation Research Board's (TRB) *Highway Capacity Manual* (HCM) as implemented in the Highway Capacity Software 2010 (HCS) capacity analysis software package. This is the industry-standard method for evaluating the capacity of intersections at isolated locations.

The ability of an intersection to accommodate traffic flow is expressed in terms of Level-of-Service (LOS), which is assigned a letter grade from A to F based on the average control delay experienced by vehicles passing through the intersection. Control delay is that portion of the total delay attributed to the traffic signal or stop sign control operation, and includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Level-of-Service A is the highest grade (best traffic flow and least delay), Level-of-Service E represents saturated or at-capacity conditions, and Level-of-Service F is the lowest grade (oversaturated conditions, extensive delays). The Highway Capacity Manual definitions for Levels-of-Service and the corresponding control delay for both signalized and unsignalized intersections are shown in **Table 3.** In the Chicago area, motorists are generally accustomed to some delays at unsignalized intersections and will tolerate LOS values of E and sometimes F provided that they are not experiencing more than one to two minutes of delay.

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Table 3: Level-of-Service Criteria

Unsignalized Intersections		
Level of Service	Average Control Delay (seconds per vehicle)	
A	0 - 10	
B	> 10 – 15	
C	> 15 – 25	
D	> 25 – 35	
E	> 35 – 50	
F	> 50 **or** volume to capacity (v/c) ratio ≥ 1.0	
Signalized Intersections		
Level of Service	Description	Avg. Control Delay (sec/veh)
A	Very good progression. Most vehicles arrive on green and proceed without stopping.	≤ 10
B	Good progression. Increased number of vehicles stopping.	> 10 – 20
C	At times, one or more vehicles may have to wait more than one signal cycle (cycle failure). Significant number of vehicles stopping, although many still pass through without stopping.	> 20 – 35
D	Volumes approaching capacity and either progression is not effective or cycle length is too long. Many vehicles stop and cycle failures are noticeable.	> 35 – 55
E	Poor Progression. High v/c ratio and long cycle length. Frequent cycle failures.	> 55 – 80
F	Very poor progression. Very high v/c ratio and long cycle lengths. Most signal cycles fail to clear vehicle queues.	≥ 80 **or** v/c ≥ 1.0

Source: Adapted from 2010 *Highway Capacity Manual*.

The results of the capacity analysis for 2016 existing conditions are summarized in **Table 4** and for 2022 total traffic conditions in **Table 5**. Summary reports from the HCS analyses are provided in **Appendix C**. As indicated in the tables, the ability of vehicles to enter IL Route 31 from unsignalized cross-streets and driveways, especially those turning left, continues to degrade due to the effects of both background and site-generated traffic. While the quantity of site-generated traffic is low to moderate at the intersections accessing the proposed site, the effect of any traffic increases along IL Route 31 resulting from development of the proposed site are amplified due to the preexisting congestion along the arterial.

Table 4: Capacity Analysis Results – 2016 Existing Traffic Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
IL Route 31 at Brighton Lane (Unsignalized)				
Westbound Left Turn	*	*	F	171.7
Westbound Right Turn	C	18.9	D	25.3
Southbound Left Turn	B	10.7	B	11.8
IL Route 31 at Drake Drive (Unsignalized)				
Westbound Approach	F	62.3	F	247.5
Eastbound Approach	*	*	F	80.1
Northbound Left Turn	B	10.7	B	10.8
Southbound Left Turn	B	10.6	B	11.9
IL Route 31 at IL Route 176 (Signalized)				
Northbound Approach	C	24.8	C	26.7
Southbound Approach	C	26.7	C	27.7
Eastbound Approach	D	47.6	D	46.7
Westbound Approach	D	47.3	D	48.9
Overall Intersection	C	33.7	C	34.3
IL Route 176 at Smith Road (Signalized)				
Northbound Approach	D	38.3	D	44.6
Eastbound Approach	A	4.7	A	5.2
Westbound Approach	A	3.8	A	3.3
Overall Intersection	A	5.8	A	4.9

LOS = Level-of-Service. Delay reported in seconds per vehicle.
*No vehicles were counted on this approach during this peak hour.

Table 5: Capacity Analysis Results – 2023 Total Traffic Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
IL Route 31 at Brighton Lane (Unsignalized)				
Westbound Left Turn	F	440.5	F	1,123.1
Westbound Right Turn	F	68.3	F	53.1
Southbound Left Turn	B	13.4	C	15.0
IL Route 31 at Drake Drive (Unsignalized)				
Westbound Approach	F	192.2	F	780.0
Eastbound Approach	-	-	F	228.0
Northbound Left Turn	B	11.7	B	12.2
Southbound Left Turn	B	12.9	B	13.6
IL Route 31 at River Birch Boulevard (Unsignalized)				
Southbound Left Turn	B	13.2	C	15.8
Westbound Left Turn	F	675.0	F	699.2
Westbound Right Turn	E	38.4	E	39.9
IL Route 31 at IL Route 176 (Signalized)				
Northbound Approach	C	27.4	C	31.8
Southbound Approach	C	30.8	C	31.4
Eastbound Approach	D	50.3	D	48.1
Westbound Approach	D	50.1	D	51.4
Overall Intersection	D	36.8	D	38.0
IL Route 176 at Carpathian Drive (Unsignalized)				
Southbound Left Turn	E	37.0	F	52.7
Southbound Right Turn	C	18.1	C	17.2
Eastbound Left Turn	A	9.7	A	9.9
IL Route 176 at Smith Road (Signalized)				
Northbound Approach	D	38.0	D	44.7
Eastbound Approach	A	5.4	A	6.3
Westbound Approach	A	4.6	A	4.1
Overall Intersection	A	6.4	A	5.8

LOS = Level-of-Service. Delay reported in seconds per vehicle.

IV. TRAFFIC EVALUATION

The results of the capacity analyses at the roadway network intersections and site access driveways are discussed below.

A. IL Route 31 at Brighton Lane

The results of the existing capacity analysis indicate that left turns onto southbound IL Route 31 from Brighton Lane are difficult due to the high volumes on IL Route 31, which result in few available gaps for left turning traffic and delays of about three minutes per vehicle. This condition significantly worsens under 2023 Total traffic conditions, where the combination of additional background traffic on IL Route 31 and additional site-generated traffic result in calculated theoretical westbound left turn delays of over 7 minutes during the A.M. peak hour and over 18 minutes in the P.M. peak hour. Realistically, left turning drivers would not tolerate delays of this magnitude. They would either alter their trip pattern or choose to travel at different times of the

day. In this case, additional motorists might divert south to the IL Route 176 access location beyond those that were routed to that access as part of the development trip assignment. Or, they may choose to turn right, and find an alternative route to head back south again (via Half Mile Road and Terra Cotta Road, for example.)

It is also possible that left turning motorists will perform a two-stage maneuver by turning onto the painted median during a gap in northbound traffic, and then waiting for a suitable gap in southbound traffic to complete the turn movement. If a two-stage left turn movement is considered, the LOS and delay improve as shown in **Table 6**. Because not all of the left turning motorists will choose to make a two-stage maneuver, the site entrance is anticipated to operate at a LOS and delay between the one-stage and two-stage results shown in the table.

Table 6. Comparison of One-Stage and Two-Stage Left Turn Movements off of Brighton Lane

Left Turn Type	A.M. Peak Hour LOS and Delay (sec/veh)		P.M. Peak Hour LOS and Delay (sec/veh)	
	Westbound LT	Westbound RT	Westbound LT	Westbound RT
One-Stage	F (440.5)	F (68.3)	F (1,123.1)	F (53.1)
Two-Stage	E (43.8)	F (68.3)	F (60.8)	F (53.1)

The Brighton Lane approach should be re-striped to more clearly provide separate left and right turn lanes. Based on Figures 36.3-A and 36.3-D of the IDOT *BDE Manual*, the existing northbound right turn and southbound left turn lanes on IL Route 31 should be maintained, as shown previously in **Table 2**. The turn lanes as they are currently constructed are of sufficient length for the amount of site-generated traffic expected to use the Brighton Lane access. Once IL Route 31 is widened, sidewalk along the south side of Brighton Road should be constructed by the developer to connect the proposed development to a future shared-use path along the east side of IL Route 31 as proposed in the Phase I study.

As discussed previously, the intersection of IL Route 31 at Brighton Lane would not warrant a traffic signal solely on the basis of traffic generated by Woodlore Estates. However, the developer should set aside some funds for cost-sharing with other developers should the signal become warranted in the future as a result of additional development.

B. IL Route 31 at Drake Drive

The results of the existing capacity analysis indicate that left turns onto southbound IL Route 31 from Drake Drive are difficult due to the high volumes on IL Route 31, which result in few available gaps for left turning traffic and delays of about 13 minutes per vehicle for westbound left turns during the P.M. peak hour. The lack of available gaps is further complicated by the restricted sight distance for left-turning motorists due to the vertical alignment of IL Route 31 north of the Drake Drive intersection. Considering the future potential for a traffic signal and better sight distance to make left turns at River Birch Boulevard, and the high volumes on IL Route 31 making left turns difficult at Drake Drive, it is anticipated that no site-generated traffic would use the Drake Drive intersection if the Purdue Place connection were opened to traffic. Therefore, no improvements to the Drake Drive intersection are proposed as a result of the traffic generated by the Woodlore Estates Development.

C. IL Route 31 at River Birch Boulevard

As indicated by the preliminary signal warrant analysis, the intersection of IL Route 31 at River Birch Boulevard would not warrant a traffic signal solely on the basis of traffic generated by Woodlore Estates. The developer should set aside some funds for cost-sharing with other developers should the signal become warranted in the future as a result of additional development. In the absence of a traffic signal, calculated delays for motorists turning left from the site during peak hours are anticipated to be high at around 11-12 minutes per vehicle. Again, left turning drivers are unlikely to tolerate delays of this magnitude and would either alter their trip pattern or choose to travel at different times of the day.

Temporary widening will need to be constructed at the River Birch Boulevard intersection to add an exclusive southbound left turn lane, as discussed previously and shown in **Table 2**. The existing northbound right turn lane for the vacant office site should be modified as part of this temporary widening. Both turn lanes should be a minimum 215 feet in length to meet deceleration requirements at a 50 mph design speed, with a corresponding taper length of 220 feet. The temporary intersection widening should be coordinated with IDOT for compatibility with the final proposed geometrics of IL Route 31 approved in the Phase I study. Once IL Route 31 is widened, a sidewalk should be constructed along River Birch Boulevard to connect to the shared-use path proposed along the east side of IL Route 31 in the Phase I study.

D. IL Route 31 at IL Route 176

The results of the existing capacity analysis indicate that the intersection currently operates at an overall LOS C during both peak hours, with delay values during both hours approaching the threshold of LOS D. With background traffic and site-generated traffic added to the intersection, the overall intersection LOS degrades to a LOS D during both peak hours, although delay increases are only three to four seconds per vehicle overall during both hours. It should be noted that individual approach Levels of Service do not change between 2016 Existing conditions and 2023 Total traffic conditions. Because the intersection has been recently reconstructed, and the magnitude of the delay increases are small, no geometric improvements are proposed at this intersection at this time. However, the traffic signal timings should be revisited upon development completion to determine if operations could be improved through reallocation of green time or a change in signal cycle length.

E. IL Route 176 at Carpathian Drive

The results of the capacity analysis under 2023 total traffic conditions indicate that left turns from this site driveway will be delayed about 40 to 60 seconds during both peak hours with the movement volumes well under capacity. As stated previously, this is not uncommon in the region, and is likely to be accepted by development residents exiting the site. Southbound right turns operate acceptably at a LOS C during both peak hours. This indicates that there is additional capacity for the intersection to process more of the westbound to southbound left turning traffic from the River Birch Boulevard and Brighton Lane intersections. It is likely that additional traffic will make this diversion if lower travel times for those motorists are realized. Left turns off of IL Route 176 onto Carpathian Drive operate very well at a LOS A during both peak hours. The Carpathian Drive approach should provide separate left and right turn lanes with a minimum 125 feet of storage and a 155 foot left turn taper to correspond to a 35 mph design speed (IDOT BDE Manual, Figure 36-3.I). Additionally, the eastbound left turn lane on IL Route 176 should be designed to provide 215 feet of storage and a 220 foot left turn taper (50 mph design speed). This work will require widening along IL Route 176 and will involve IDOT coordination and permitting.

F. IL Route 176 at Smith Road

The results of the existing capacity analysis indicate that the intersection currently operates at an overall LOS A during both peak hours. With background traffic and site-generated traffic added to the intersection, the overall intersection LOS remains at a LOS A during both peak hours, and individual approach Levels of Service are unchanged between 2016 Existing conditions and 2023 Total traffic conditions. Because the intersection operations are unchanged from existing conditions, no improvements are proposed as a result of the Woodlore Estates development at this intersection.

V. INTERNAL SITE CIRCULATION

Review of the local street network proposed within the site indicates that while there appears to be a north-south roadway planned to function as a collector, it is not contiguous through the entire site, although it is significantly improved over the July 20, 2016 site plan. An additional improvement would be to eliminate the remaining 90-degree turn in the near the midpoint of the site and curve the roadway to make a continuous corridor instead. left or right turns onto different streets in the center section of the site to continue their trips. These turns could be reduced by adjusting the alignment to remove the need for a sharp turn and provide better continuity. We understand that due to the connection at Brighton Lane, trips from The Fountains and The Springs will possibly be utilizing the Woodlore Estates roadway network, but we believe that this situation will occur regardless of the development's roadway configuration. Making sure that there is a properly designed roadway through the development to carry this traffic, as well as Woodlore Estates traffic, is important.

The site plan shows a clear parcel near the middle of the site on the west edge of the collector roadway. This parcel is approximately in line with the east end of the Drake Drive alignment in the College Hill subdivision to the west. It would be desirable to maintain this parcel as a clear area for pedestrian access between the subdivisions and as a possible street connection should the need arise in the future.

The Carpathian Drive connector to IL Route 176 is a collector street and should be realigned so that its northern terminus directly intersects River Birch Boulevard. Not only will this provide continuity for the roadway network, but it minimizes the distance that traffic accessing other parts of the site travels along local residential streets. Excessive through traffic on a street that has a residential feel with several homes facing the roadway and many driveways results in discomfort for those homeowners located along the street, which is undesirable.

VI. CONCLUSIONS AND RECOMMENDATIONS

Based on the proposed development plan and the preceding traffic impact study, the following conclusions and recommendations are presented.

- The proposed development generates a moderate number of trips which will not significantly increase delays on IL Route 31.
- No improvements are proposed to the IL Route 31/IL Route 176 intersection as a result of the proposed development, as the increase in intersection delay is minor and the intersection was recently reconstructed to a maximum cross-section. Coordination with IDOT will be needed to determine if the traffic signal needs to be re-timed upon full development of the proposed site.
- Site-generated traffic will have difficulty exiting the site at unsignalized intersections with the current two-lane configuration of IL Route 31.

- No changes are proposed at the Brighton Lane/IL Route 31 intersection at this time, other than restriping the Brighton Lane approach to provide separate left- and right-turn lanes.
- At the River Birch Boulevard intersection, a southbound left turn lane should be constructed and the existing northbound right turn lane should be modified. The turn lanes should at minimum provide 215 feet of storage and have a 220 foot taper length. This work will require interim widening on IL Route 31.
- The developer should set aside funding to share in the cost of installing a future traffic signal at River Birch Boulevard or Brighton Lane with the City and/or other developers. If warranted and installed prior to IDOT's proposed widening of IL Route 31, any traffic signal should be constructed as a temporary span wire installation.
- The existing access drive just north of River Birch Boulevard should be removed and a driveway stub to the parcel should be provided off of River Birch Boulevard.
- Sidewalks should be constructed along Brighton Lane and River Birch Boulevard upon widening of IL Route 31 to connect the development to the future mixed-use path along IL Route 31 that is proposed in the Phase I study.
- Appropriate right-of-way should be dedicated per the IL Route 31 Phase I plans for any sections of the development parcel(s) that have frontage along IL Route 31.
- The Carpathian Drive approach to IL Route 176 should provide separate left and right turn lanes designed with a minimum of 125 foot of storage and a 155 foot left turn taper.
- An eastbound left turn lane should be provided on IL Route 176 at Carpathian Drive. The lane will need to provide 215 feet of storage and a 220 foot taper. IL Route 176 will need to be widened to provide the left turn lane. No westbound right turn lane is required based on anticipated volumes from the Woodlore Estates development.
- No improvements are proposed at the IL Route 176/Smith Road intersection, as intersection operations remain the same upon site development as under existing conditions.
- It would be desirable to remove the remaining 90-degree turn in the north-south collector street and replace it with a curved roadway for continuity.
- The existing vacant parcel near the location of the east end of Drake Drive should be maintained for pedestrian access as well as a future street connection if one ever becomes desirable.
- The access from IL Route 176 via Carpathian Drive should directly connect to River Birch Boulevard. This would eliminate the need for traffic entering and existing the site to travel through residential areas on local streets, which is undesirable for residents.