City of Waco Landfill
McLennan and Limestone Counties
TCEQ Permit No. MSW-2400

October 2020 Technical Notice-of-Deficiency Response
Unmarked Version, Volume 1 of 2

Prepared for

City of Waco

Solid Waste Services
501 Schroeder Drive
Waco, Texas 76710

Prepared by:

SCS ENGINEERS

SCS Project No. 16216088.00
Revision 3 (Parts I/II) and Revision 1 (Part III/IV) – October 2020

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October 7, 2020
SCS Project No. 16216088.00

Mr. Eric Clegg
Municipal Solid Waste Permits Section
Waste Permits Division (MC-126)
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg. F
Austin, TX 78753

Re: Proposed City of Waco Landfill - McLennan and Limestone Counties, Texas
Municipal Solid Waste - Permit Application No. 2400
New Permit Application - Notice of Deficiency Response
Tracking No. 23201563; RN110471307/CN600131940

Dear Mr. Clegg:

On behalf of the City of Waco, SCS Engineers has prepared the following response to the Texas Commission on Environmental Quality's (TCEQ's) August 19, 2020 New Permit Application, Notice-of-Deficiency (NOD) letter, related to a permit application for the proposed City of Waco Landfill, TCEQ Permit No. MSW-2400.

For ease of review, we have attached to this response letter your original comment table from your August 19, 2020 NOD letter with the response location and response statements provided in separate columns in the table.

Additionally, attached to this response letter, we have included one original and two (2) unmarked copies, and one marked copy of all revised pages for use as replacement pages in the permit application. Where possible, we have identified proposed changes from the existing permit application in a redline/strike-out version (i.e., marked version), with exception to Microsoft Excel tables show changes in red font and highlighted yellow. Additionally, we have included a revision date (October 2020) and revision number (Revision 3 for Parts I/II and Revision 1 for Parts III/IV) on pages that have been revised as part of this NOD response. Furthermore, we have attached a signed Part 1 Form, and posted this response on the publically accessible internet website.

Lastly, you will note that we have included supplemental revisions to the application for the following (some of which are identified in the NOD response table where appropriate):

- Parts I/II were updated for the following:
    - Revised classification of wastes to be accepted (Section 2.2), decreased waste disposal area acreage (Section 2.1 and applicable drawings), revised site geology (Section 9), floodplain delineation and statement (Section 11 and applicable drawings), and landfill personnel (Section 16).
    - Revised description of onsite easements (Section 3).
    - Revised landowner's map and list (Section 5).
    - Revised traffic information for consistency with the added traffic impact analysis and coordination with TxDOT (Section 8).

- Revised metes and bounds survey and legal description to reflect changes to the landfill property ownership, onsite easements, and adjoining property ownership (Attachment 14A).
- Revised information for City of Waco Key Personnel (Section 16).
- Revised Drawings I/II-2, 3, 4, 5, and 7, including the surveyed flowage easement (see below).
- Added correspondence to/from agency coordination (Appendix I/IIA).
- Updated Land-Use Analysis (Appendix I/IIC).
- Updated Section 404 Jurisdictional Determination (Appendix I/IIE).
- Added Biological Assessment Report (Appendix I/IIG).

- Part III attachment drawings were updated to depicted the surveyed flowage easement (534.5 ft NGVD 29 contour). As a result, minor reductions were made to the limits of waste boundary on the east side of the West Disposal Area (WDA) and east and a portion of the south side of the East Disposal Area (EDA) to avoid encroachment into the flowage easement. As such, the following portions of the application were revised:
  - All applicable drawings that depict the limits of waste boundary.
  - Site life calculations (Appendix IIIA) were updated to reflect the reduced capacity of the landfill.
  - Part III, Section 2.2 and Attachment 9, Section 3.2.2 were updated with the revised site operating life and maximum inventory of waste ever onsite, respectively.
  - Attachment 6A, related to necessary updates to the surface water drainage calculations and/or modeling.

We trust that our responses will assist you in the completion of your technical review. If you have any questions or need additional information, please do not hesitate to contact Ryan Kuntz, P.E. at (817) 358-6117.

Sincerely,

James Lawrence

Jim Lawrence, P.G.
Project Director
SCS Engineers
TBPE Registration No. F-3407

Ryan Kuntz, P.E.
Vice President/Satellite Office Manager
SCS Engineers

Attachments: as described herein

cc: Mr. Charles Dowdell, City of Waco
Mr. Jeffrey Reed, Lloyd Gosselink Rochelle & Townsend, P.C.

NOTICE-OF-DEFICIENCY RESPONSE TABLE

NOD ID	MRI ID	App. Part	Citation	1st NOD Type	NOD Description	Response Location	Response
NT1	141	Part II	330.61(i)(4)	Incomplete	Provide Traffic Study and TXDOT approvals.	Parts I/II, Appendix I/IID-2.	The Traffic Impact Analysis (TIA) and associated approval has been added to a new Appendix I/IID-2.
T2	162	Part II	330.61(m)(1)	Incomplete	Provide all documents pertaining to new floodplain elevations and address the status of any letter of map revisions submitted to FEMA regarding the new flood plain elevations.	Attachment 6B, Drawing 6B.1 and identified attachments.	Drawing 6B.1 has been revised to include the revised 100-year floodplain FIRM Map (dated 12/20/2019) for McLennan County. Additionally, Drawings 1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 3.2, 3.3, 4.19, 6A.2, 6A.3, 6B.3, 11.1, 12.1, and 12.2 have been revised to reflect the updated 100-year floodplain delineation for McLennan County, based on the revised 12/20/2019 FIRM map. Both the McLennan and Limestone County 100-year floodplain delineations are designated as Zone A, as such they are not based on detailed analyses or base flood elevations. Furthermore, landfill development does not propose a disturbance or fill placement within the boundary of 100-year floodplain, therefore a CLOMR or subsequent LOMR is not required for this project.
T3	162	Part II	330.61(m)(1)	Incomplete	See ID 163	Part I/II, Section 11.1 and Part III, Section 3.7	This citation is not applicable, as described in response to Comment T4. In addition, an independent drainage analysis was performed to ensure that all waste would be disposed outside of the areas impacted by a 100-year storm event. The drainage analysis is provided Attachment 6B, and the area calculated as potentially impacted by the 100-year storm event is graphically shown at Drawing 6B.3 and other applicable drawings throughout the application.
T4	163	Part II	330.61(m)(2)	Incomplete	Provide all correspondence with the US Army Corps of Engineers (USACE) regarding the jurisdictional determination for potential waters of the US (WOTUS) within the permit boundary and any authorization from the USACE pertaining to WOTUS.	Parts I/II, Appendix I/IIE	An updated Section 404 Jurisdictional Determination report, dated March 2020, has been included Appendix IIE. This report has been prepared to completely replace the previously submitted August 2018 report. Additionally, at the time of preparing this NOD response, a response letter from the USACOE has not been received on this determination or the submitted Section 404 permit application (submitted 6/24/2019). The City's jurisdictional waters consultant (Horizon Environmental Services) has been working through USACOE comments on the permit application since that time. As such, Parts I/II will be updated with USACOE's response to coordination related to the determination and/or approval of Section 404 permit application once these items are obtained. Due to the size of the correspondence related to the 404 permit application we have opted to not include this document and related correspondence in it's entirety in the permit application. However, if TCEQ would like the City to provide this information as a separate submittal for TCEQ's records, please let us know.
NT5	167	Part II	330.61(o)	Incomplete	Provide THC approval letter for revisions to buffer zone around cemetery.	Parts I/II, Appendix I/IIA	The requested THC approval letter has been added to Appendix I/IIA.
T6	214	Part II	330.553(a) & (b)	Omitted	Provide a Corps of Engineers Section 404 permit for construction of all necessary improvements (e.g. perimeter access road culvert).	Parts I/II, Appendix I/IIE	Related to citation references for both §330.553(a) & (b), no MSW storage facilities, processing facilities, new MSW landfill units, lateral expansions, or material recovery operations from a landfill are are proposed to be located within wetlands, as

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							indicated in Appendix I/IIE. As such, these citations are not applicable to this application. Related to the reference to perimeter access road culvert in your comment, the access road culverts proposed for the Horse Creek and tributary road crossings have been included in the Section 404 Jurisdictional Determination report (see Appendix I/IIE), and are also included the USACOE Section 404 permit application (see response to Comment T4).
T7	215	Part II	330.553(b)(1)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T8	216	Part II	330.553(b)(2)(A) - (D)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6. However, related to §330.553(b)(2)(C), note the landfill will not will not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, or cause or contribute to the taking of threatened or endangered species or result in adverse impact to critical habitat of threatened or endangered species (see Appendices I/IIA and I/IIG).
T9	217	Part II	330.553(b)(3)(A)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T10	218	Part II	330.553(b)(3)(B)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T11	219	Part II	330.553(b)(3)(C)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T12	220	Part II	330.553(b)(3)(D)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T13	221	Part II	330.553(b)(3)(E)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T14	222	Part II	330.553(b)(3)(F)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T15	223	Part II	330.553(b)(5)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
T16	224	Part II	330.553(b)(4)	Incomplete	See ID 163	N/A	This citation is not applicable, see response to Comment T6.
NT17	230	Part II	330.543(a)	Incomplete	Submit documentation that the 10-foot fiber optic easement has been removed from the WDA.	Part I/II, Sections 3 and 14; and Part IV, 4.6.1	The fiber optic easement has been released by UPRR. References to the recorded easement release is shown on the marked version of the revised metes and bound survey included in Part I/II, Section 14. Additionally, this survey has been updated to depict the flowage easement, revised waterline easement, McLennan County floodplain delineation, and property ownership.
T18	271	Part III	330.63(b)(2)	Incomplete	No process design discussion of CCS and recyclables processing and storage.	Part III, Section 3.11	Although most of the requested information is included throughout Part IV – Site Operating Plan; Section 3.11 has been added to Part III Narrative summarize the overall design and operation of the CCS to address this comment.
NT19	272	Part III	330.63(b)(2)(A)	Omitted	Flow diagram required.	Attachment 1	Drawing 1.6 (Attachment 1) has been added in response to this comment.
T20	290	Part III	330.305(a)	Incomplete	See ID 312	N/A	Attachment 6A, Section 5.3 already substantiates that the existing drainage patterns will not be adversely altered. Also see response to Comment T30. As such, no other revisions were made in response to this comment.
T21	302	Part III	330.305(g)	Incomplete	Provide plan and cross-sectional view drawings for the leachate storage tanks.	Attachment 12, Section 4 and Drawings 12.1 and 12.2	Attachments 12.1 and 12.2 have been revised to depict the location of the permanent leachate storage tanks (Option 2). Additionally, Attachment 12, Section 4 has been revised to specify the number, capacity, location, foundation of each tank option, as well as the design of double-contained tanks.

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							Lastly, since some of the generalized details are or have been included in Attachment 12 narrative related to the size, locations, and methods for leachate storage tank design and installation, typical cross-section(s) of the tanks are not required or included with this response.
NT22	303	Part III	330.63(c)(1)(A)	Ambiguous	Eastern basin of West Disposal Area incorrectly titled "West Basin".	Applicable Attachment 1, 2, 3, 4, 11, and 12 Drawings	Drawings 1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 3.2, 3.3, 4.19, 11.1, 12.1, 12.2 have been revised to rename the "WDA, West Basin" as "WDA Basin".
T23	303	Part III	330.63(c)(1)(A)	Inconsistent	POD-9 contributing drainage areas are inconsistent.	Attachment 6A, Section 3	Attachment 6A, Section 3, the following 2 bullet points have been changed from: • PRE-8A, PRE-8B, PRE-8C, OS-1 and OS-2 contribute runoff to and discharge at POD-8. • PRE-9A contributes runoff onto OS-3, which flows back on-site to PRE-9B and discharges at POD-9. To: • PRE-8A, PRE-8B, PRE-8C, PRE-8D, OS-1, OS-2, and OS-3 contribute runoff to and discharge at POD-8. • PRE-9 contributes runoff to and discharges at POD-9.
T24	304	Part III	330.63(c)(1)(B)	Incomplete	Provide drawings showing the drainage areas for Pre 8A HC & Pre-8C HC for pre-development conditions; and OS-1 and Pre-8C HC for post development conditions.	Attachment 6A, Drawing 6A.2	In Appendix 6A-B, HEC-HMS Pre-Development Input/Output Files, Pre 8A HC and Pre 8C HC are modeled as reaches and as such do not have drainage areas. Note, the suffix HC stands for Horse Creek. Pre 8A HC transfers the flow from OS-1, downstream to Junction-1, where it combines with the flows from drainage areas Pre-8A, Pre-8B, and OS-2. Pre 8C HC transfers flows from Junction 1, to POD-8, where it combines with the flows from Pre-8C, Pre-8D, and OS-3. In Appendix 6A-C, HEC-HMS Post-Development Input/Output Files, Pre 8C HC is modeled as a reach and as such does not have a drainage area. Pre 8C HC transfers flows from Junction 1, to POD-8, where it combines with the flows from Pre-8CR, Pre-8DR, OS-3, and the WDA Basin and the EDA West Basin. OS-1 is an off-site drainage basin that is shown on Drawing 6A.1B. A note has been added to Drawing 6A.2 stating "For information on drainage area OS-1, see Drawing 6A.2."
T25	304	Part III	330.63(c)(1)(B)	Incomplete	Provide drawings showing the drainage areas "Example-1 — 3" and "Example DC", an explanation of what these areas represent, and supporting design calculations.	Attachment 6A, Appendix 6A-E	The intermediate cover drainage areas to drainage swales and downchutes is discussed in section 6.2.3, Specifications for Typical Structural BMPs. In the Intermediate Cover – Drainage Swale Flow Analysis, the following note has been added stating: "Example 1 represents the largest intermediate cover topslope drainage area to any one drainage swale. Example 2 represents the largest intermediate cover sideslope drainage area to any one grass-lined drainage swale. Example 3 represents the largest intermediate cover sideslope drainage area to any one rip rap or TRM lined drainage swale."

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							In the Intermediate Cover – Downchute Flow Analysis, the following note has been added stating: "Example DC represents the largest intermediate cover drainage area to any one downchute." A Trapezoidal Channel Analysis Normal Depth Computation has been added.
T26	304	Part III	330.63(c)(1)(B)	Inconsistent	Flow velocity for "DC4" is inconsistent.	Attachment 6A, Appendix 6A-E	The flow velocity in the Intermediate Cover – Downchute Flow Analysis for DC4 has been changed from 12.17 to 12.71 fps.
T27	307	Part III	330.63(c)(1)(C)	Ambiguous	Define runoff coefficient superscript "5".	Attachment 6A, Appendix 6A-E	The runoff coefficient superscript "5" has been removed from the following: • Intermediate Cover – Drainage Swale Flow Analysis • Final Cover – Drainage Swale Flow Analysis • Intermediate Cover – Downchute Flow Analysis • Final Cover – Downchute Flow Analysis
T28	307	Part III	330.63(c)(1)(C)	Inconsistent	Runoff coefficient for "SW7" is inconsistent with top slope conditions (e.g. 0.35).	Attachment 6A	The runoff coefficient for drainage area SW7 in the Final Cover – Drainage Swale Flow Analysis has been changed to 0.35.
NT29	311	Part III	330.63(c)(1)(D)(ii)	Inconsistent	Revise the reference (e.g. Drawing 6A-19) to cite the correct drawing number where swale design drawings are located.	Attachment 6A, Appendix 6A-E	The reference in the Final Cover – Drainage Swale Flow Analysis to "See Drawing 6A-19 for drainage swale details" has been changed to "See Drawing 6A-12 for drainage swale details."
T30	312	Part III	330.63(c)(1)(D)(iii)	Omitted	Include a velocity comparison at all discharge points, including Reservoir 19.	Attachment 6A, Appendix 6A-E	As shown in Table 6A-5-1, the post-development peak discharge rates at 10 of the eleven POD locations (PODs 1 through 7 and 9 through 11) are either unchanged from the pre-development discharge rates or are lower (decreases anywhere from 2.7 percent to 56.5 percent). Therefore, the discharge velocities from these POD's is either the same or reduced from the pre-development velocities. The post-development peak discharge rate for POD-8 is 1.5 percent higher than the pre-development flow rate. This POD discharges into a 190-foot wide portion of Reservoir 19 at its normal pool elevation. Therefore, this would have no adverse impact on the downstream receiving structure, Reservoir 19. Calculations have been added to Appendix 6A-E for calculation of the energy dissipation impacts on the discharge of the three detention basins to show the peak discharge velocities are below non-erosive velocities and do not pose any adverse impacts on the downstream receiving structures.
T31	315	Part III	330.63(c)(2)(B)	Omitted	Provide the calculated 100-year floodplain elevation within the permit boundary and update all applicable drawings to include this elevation.	Attachment 6B	The elevations for the 100-Year Storm Event Water Surface have been added to a table on Drawing 6B-3 in response to this comment. The delineated boundary of this water surface was developed from these elevations, as shown on other applicable drawings in the application. As such, as discussed with TCEQ on 9/2/2020, the referenced elevations were only included on Drawing 6B.3.
T32	335	Part III	330.63(c)(2)(D)(i)	Incomplete	See ID 214	Part I/II, Section 11.1 and Part III, Section 3.7	Please check the referenced ID. Based on review of the citation, it appears this comment is related to ID T3. This citation is not applicable to this landfill, since construction within a floodplain is not proposed. See response to comments T2 and T3.
T33	376	Part III	330.333(A)-(G)	Inconsistent	The following information is inconsistent with HELP model: Case 4 (no recirculation) - peak daily drainage, average annual drainage, and average annual daily drainage; and Case 3 (with recirculation) - average annual runoff.	Attachment 12, Appendix 12A, pages 12A-16 & 12A-18	The identified values in HELP model summary tables on pages page 12A-16 for Case 4 (no recirculation) and page 12A-18 for Case 3 (with recirculation) have been revised to match model results as requested.

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T34	380	Part III	330.337(b)(2)	Incorrect	Revise the quoted sentence in the first paragraph on page 10-2-3 (Attachment 10, Section 2.5) as the following: “Short-term stability against uplift of the liner system will be required by installation and operation of an active underdrain system when the excavation is below the SHWT" and ...	N/A	The May 2020 submittal of the application, specifically Attachment 10, Section 2.5.2, included evidence that the soil surrounding the landfill is so poorly permeable that groundwater cannot move sufficiently to exert force that would damage the liner in accordance with §330.337(b)(3). The evidence provided included an analysis of travel time through the formations present at the site. For this analysis, it should be noted that the groundwater velocity within the formations at the site was based on the maximum velocity measured; however, velocities measured actually ranged from 0.008 to 0.039 ft/year (see Attachment 4, Table III-4.14). Therefore, this analysis is considered conservative. Additionally, to further confirm the that the formations are so poorly permeable at the site, we have performed additional permeability testing on undisturbed soil samples in response to Comment T64. These permeability results are provided in Attachment 4, Appendix III-4.F and summarized in Attachment 5, Table 5-2-7. As shown, the permeability of the formations both along the horizontal and vertical axis are approximately the same or lower than the slug test results used for the travel time analysis in all cases, with the exception of two cases. Although, the exceptions are considered isolated anomalies, the following should be noted related to these exceptions: • Related to the horizontal permeability of the sample collected at B-4 at 35-feet ($6.71x10^{-6}$ cm/s), this sample is associated with a depth of approximately 515 ft MSL, which is below the proposed excavation grades at the B-4 location. Additionally, we consider this permeability result an outlier likely due to disturbance during sample collection or preparation. Either way, this sample zone is below our proposed landfill bottom in this area and will not impose an uplift pressure on the liner system. • Related to the horizontal permeability of the sample collected at B-20 at 15-feet ($1.27x10^{-7}$ cm/s or average for Unit II at this location of $7.9x10^{-8}$ cm/s), this sample is associated with a depth of approximately 550 ft MSL. As such, based on the proposed excavation grades, the material near the depth that this sample was taken will be completely excavated during landfill development. Additionally, there is no evidence of groundwater at this elevation where the sample was taken, as groundwater within the upper zone (Unit II) at the site near the B-18 or B-20 locations have been documented to be between approximately 525 to 520 ft MSL. Furthermore, as discussed in Attachment 10, Section 2.5.3 the shallow occurrences of groundwater (upper zone) do not appear to be uniform across the site and likely occur in isolated pockets, which are surrounded by low permeable soil, as reflected by the absence of water at other shallow stand-pipe piezometers and vibrating wire piezometers (VWP), including VWP-19 (between PZ/VWP-20 and PZ/VWP-18). Therefore, since the

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							seasonal high water table is below this zone in this area of the landfill, no uplift pressure will be exerted on the landfill liner system at this sample zone. Based on the collected data, shallow occurrences of groundwater near the excavation grades of the landfill generally occur in Unit II, which has a permeability reflective of the slug test results presented in Table III-4.13, which are in the range of 2.77 x 10^{-8} cm/s or velocity of 0.016 ft/day (lower than used in the demonstration provided in Attachment 10). As such, based on the evidence presented in the May 2020 submittal and additional soil testing presented with this NOD response, the soil surrounding the landfill is so poorly permeable that groundwater cannot move sufficiently to exert force that would damage the liner in accordance with §330.337(b)(3). Therefore, no additional revisions have been made in response to this comment. Note, due to updated water level data provided in Attachment 4, and subsequent updates to Table III-4.14, references to the travel time analysis data was updated in Attachment 10, Section 2.5.2 (page 10-2-4).
T35	380	Part III	330.337(b)(2)	Incorrect	(cont.) remove "if groundwater seepage is observed during construction over an extended period of time". Revise Section 2.5.2 and other relevant portions of the application consistent with these revisions.	N/A	See response to comment T34.
T36	385	Part III	330.337(e)	Incomplete	Provide information on how the unit weights for geosynthetics used in the slope stability model were obtained.	Attachment 5, Section 4.3.3	In the slope stability model, the layer that represents the soil and geosynthetic layers has a typical assumed unit weight of 100 pcf (see Attachment 5, Appendix 5A, Page 5-A-20, table showing Layer 4 or 5). This is a reasonable unit weight value used in the analysis, since the geosynthetics are a relatively very thin layer and have no significant contribution in computing the driving force of each slice column above the failure plane. Based on our experience with modeling, the geosynthetic unit weight would not affect the factor of safety calculated. Hence, we typically use 100 pcf for these combined thin layers. Attachment 5, Section 4.3.3, page 5-4-5, has been revised with this assumed value.
T37	385	Part III	330.337(e)	Ambiguous	Provide sample calculations and a discussion explaining the methods and formulas used for primary and secondary settlement analysis.	Attachment 5, Appendix 5C	The EXCEL spreadsheets presented in Appendix 5C follow the methods, assumptions and formulations as described in Attachment 5, Section 5.0. Appendix 5C also presents similar information, and calculations were performed and presented in the EXCEL spreadsheets for the foundation primary settlement for geology Unit II as well as the final cover settlement due to primary and secondary settlement of the waste mass. To verify the numbers presented in this spreadsheet, a sample calculation of one settlement point is presented with this NOD comment response. Furthermore a discussion in explaining the methods and formulae used for the primary and secondary settlement analysis is already presented in Section 5.0.

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							Currently we are performing a 1-D consolidation test on an undisturbed Shelby tube sample taken from Unit II (weathered formation) near a soil boring in the EDA. As soon as the test result is available, we will update relevant sections and Appendix 5C accordingly, if necessary. However, the results obtained are not anticipated to have a material effect on the overall foundation settlement calculations.
T38	385	Part III	330.337(e)	Incomplete	Provide the pre-consolidation stress and indicate whether the soils in the EDA and WDA are normally consolidate, over consolidated, or under consolidated.	N/A	As described in Attachment 5, Section 5.2, the weathered soil (Unit II) in either EDA or WDA is assumed to be a normally consolidated soil stratum because there was no prior preloading condition at the site, especially since the site is too far south from any influence of past glacial activities. Hence, the pre-consolidation stress experienced by this soil layer is essentially equal to the existing overburden pressure. However, see response to Comment T37, related to forthcoming test results for a 1-D consolidation test, which is anticipated to confirm this assumption.
T39	400	Part III	330.339(a)(2)	Incorrect	To comply with §330.339(a)(2) and §330.339(c), revise Attachment 10, Section 1.1 to reference the current TCEQ guidance, RG-534 (2017 version); and revise the SLQCP to be consistent with the RG-534. RG-534 can be downloaded from the agency's website at https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg-534.pdf .	Attachment 10 Section 1.1	This comment has been addressed as requested.
T40	401	Part III	330.339(a)(2)	Inconsistent	The testing frequency for geomembrane manufacturer quality control testing is inconsistent with GRI GM-13.	Attachment 10, Section 4.2.1	This comment has been addressed as requested.
T41	401	Part III	330.339(a)(2)	Inconsistent	The testing frequency for conformance testing for geomembrane thickness is inconsistent with RG-534.	Attachment 10, Table 10-4-1	Table 10-4-1 in Section 4.2.2 has been revised to require thickness testing at 1 per 50,000 ft^2 and every resin lot consistent with RG-534.
T42	401	Part III	330.339(a)(2)	Incomplete	The testing procedures for geomembrane (Resin) is inconsistent with RG-534.	Attachment 10, Section 4.2.1	The testing frequency for geomembrane resin has been revised to be consistent with industry standards, one per batch and every resin lot.
T43	401	Part III	330.339(a)(2)	Inconsistent	The evaluation of destructive seam testing results is inconsistent with GRI GM-19(a).	Attachment 10, Section 4.4.2 and Table 10-4-2	This comment has been address as requested.
T44	402	Part III	330.339(a)(2)	Incomplete	Manufacturer and conformance testing for geocomposite material is inconsistent with RG-534 with respect to the liner and final cover systems.	Attachment 10, Section 5.3	Section 5.3 of Attachment 10 has been revised to address this comment. Manufacturer testing has been required for properties which have an impact on the functionality of the geocomposite for leachate collection. Additionally, conformance testing for transmissivity and ply adhesion has been included.
T45	411	Part III	330.339(c)(3)	Ambiguous	Revise the fifth bullet in Section 3.3.1 to clarify whether the specified compaction will result in a soil liner with a permeability of 1x10-7 cm/s or less as specified in Section 3.1.	Attachment 10, Section 3.3.1	This comment has been addressed as requested.
T46	412	Part III	330.339(c)(4)	Ambiguous	Revise Table 10-4-1 and other relevant portions of Section 4 to be consistent with the TCEQ RG-534 (tests, methods, and frequencies).	N/A	See responses to Comments T40 through T43. No other changes have been made in response to this comment, as our review indicates Section 4 meets or exceeds the criteria of RG-534.
T47	412	Part III	330.339(c)(4)	Ambiguous	Revise Sections 5 and 6 to include tables listing test requirements consistent with Table 10B-4 of the TCEQ RG-534.	Attachment 10, Sections 5.3 and 6.3	Sections 5.3 and 6.3 have been revised to include testing schedules per your quest. Manufacturer testing has been

NOD ID	MRI ID	App. Part	Citation	1st NOD Type	NOD Description	Response Location	Response
							required for properties which have an impact on the functionality of the geocomposite and geotextile for leachate collection.
T48	412	Part III	330.339(c)(4)	Ambiguous	For easy reference, include Tables 10B1, 10B-2 and 10B-4 of the RG-534 in Appendix 10A; and revise text in Attachment 10 to refer to these tables.	Attachment 10, Appendix 10A	Summary tables for soil liner, geomembrane, geocomposite, and geotextile testing are included in Appendix 10A per your request. As indicated in Comments T44 and T47, testing for material properties which have an impact on the functionality of the specific liner layer have been included.
T49	416	Part III	330.339(c)(6)	Incomplete	Revise the quoted sentence in Section 3.2.1 as the following: "Testing will be performed in the laboratory according to the testing schedule set forth in Table 10-3-1."	Attachment 10, Section 3.2.1	This comment has been addressed as requested.
T50	419	Part III	330.339(c)(7)	Inconsistent	Consistent with the TCEQ RG-534, revise Table 10-3-2 to list necessary information for field permeability test as a required test; revise to specify that a liner will be accepted only when both tests (field and laboratory) yield a passing result (i.e., no greater than 1x10-7 cm/s). Revise other relevant portions of the application accordingly.	N/A	In accordance with our discussion and email from TCEQ on 9/2/2020, field permeability test for constructed soil liners is not a required test; therefore, no changes to Table 10-3-2 have been made.
T51	422	Part III	330.339(d)	Ambiguous	Consistent with §330.339(d), revise Section 3 to clearly state that soil and liner density shall be expressed as a percentage of the maximum dry density and at the corresponding optimum moisture content.	Attachment 10, Sections 3.2.1 and 3.3.1	This requirement was already included in Section 3.2.1; however we have relocated this sentence for organization with content in this section. Additionally, Section 3.3.1 has been revised to include this requirement.
T52	489	Part III	330.63(e)(4)(B)	Inconsistent	B-1 and B-3 are not listed in Table III-4.5 as being 30 feet below the EDE as proposed in SBP, however logs show them as drilled deeper than listed.	Attachment 4, Table III-4.5	Revised Table III-4.5 to update the B-1 and B-3 drilling depths.
T53	491	Part III	330.63(e)(4)(D)	Incomplete	Include State Well Reports for VWP wells or include justification for omission.	Attachment 4, Section 6.2	Added justification for omitting state well reports for VWP's.
T54	494	Part III	330.63(e)(4)(G)	Incomplete	Extend cross-section F-F' to include northwest part of West Disposal Area.	Attachment 4, Figure 4.15	Included Borings B-17 and B-1 into cross-section F-F' per your request.
T55	494	Part III	330.63(e)(4)(G)	Inconsistent	Revise cross-sections to include logs from deeper borings including VMPs to address lower GW zone.	Attachment 4, Figures 4.12 and 4.14	Revised figures to include boring B-9 into cross-Section E-E' and expanded boring B-43 into cross-section C-C' and E-E'.
T56	494	Part III	330.63(e)(4)(G)	Inconsistent	B-1, B-3, and B-43 are shown as ending shallower in cross-sections than in logs.	Attachment 4, Figures 4.10, 4.12, and 4.14	Revised the total depth of B-1, B-3, and B-43 on associated cross-sections.
T57	494	Part III	330.63(e)(4)(G)	Incomplete	Add screened intervals to cross sections for piezometers.	Attachment 4, Figures 4.10, 4.11, 4.12, and 4.14	Added screened intervals for piezometers on associated cross-sections.
T58	494	Part III	330.63(e)(4)(G)	Inconsistent	Water level shown incorrect for B-20.	Attachment 4, Figure 4.12	Corrected water level on B-20 on cross-section.
T59	494	Part III	330.63(e)(4)(G)	Inconsistent	B-36 is incorrectly shown having grade level at 520' instead of 532.5' as shown in log.	Attachment 4, Figure 4.13	Corrected B-36 on cross-sections to show grade level at 532.5'
T60	494	Part III	330.63(e)(4)(G)	Incomplete	Indicate stratigraphic units (I, II, & III) in cross sections.	Attachment 4, Figures 4.10 – 4.15, Appendix III-4.D	Indicated stratigraphic units on cross-sections. In order to maintain consistency between the cross-sections and the geolology logs, the logs have been revised to clearly show Unit I, and a consistent Unit I graphic has been incorporated.
T61	494	Part III	330.63(e)(4)(G)	Inconsistent	Revise contacts between weathered and unweathered zones to be consistent with logs.	Attachment 4, Figures 4.10 – 4.15	Revised contacts between weathered and unweathered zones on cross-sections to be consistent with logs.

NOD ID	MRI ID	App. Part	Citation	1st NOD Type	NOD Description	Response Location	Response
T62	497	Part III	330.63(e)(5)(A)	Incomplete	Provide laboratory data sheets for all test results and revise summary tables to include all missing data.	Attachment 4, Appendix III-4.F	Laboratory data sheets have been provided for all test results. Missing data related to summary tables are provided in Attachment 4, Appendix III-4.F, pages: 4-F-28, 4-F-67, 4-F-68.
T63	497	Part III	330.63(e)(5)(A)	Omitted	Provide an independent third-party laboratory report for sieve analysis, Atterberg limits, and moisture content for the Unit I soil layer with respect to the EDA and WDA.	Attachment 4, Appendix III-4.F and Attachment 5, Section 2 tables	This comment has been addressed as requested, with lab results provided in Attachment 4, Appendix III-4-F and summarized in Attachment 5, Tables 5-2-2, 5-2-3 and 5-2-8. Note, a typographical error was also corrected in Table 5-2-2 for B-43.
T64	498	Part III	330.63(e)(5)(B)	Incomplete	Provide horizontal and vertical permeability testing information for undisturbed soil samples for each soil layer (e.g. Unit I, II, & III) the EDA and WDA are located in.	Attachment 4, Appendix III-4.F and Attachment 5, Section tables	This comment has been addressed as requested, with lab results provided in Attachment 4, Appendix III-4-F and summarized in Attachment 5, Tables 5-2-1, 5-2-7 and 5-2-8. Attachment 5, Section 2.6.3 was revised to discuss the undisturbed permeability test results, with specific emphasis on Unit II which forms the sideslopes and base of the landfill excavation. Also note, Table 5-2-6 was revised to include the standard proctor information used for preparation of the remolded samples tested for hydraulic conductivity.
T65	499	Part III	330.63(e)(5)(B)(i)	Incomplete	See ID 498	Attachment 4, Appendix III-4.F and Attachment 5, Table 5-2-	This citation is not applicable, as the falling head method was used for evaluating permeability consistent with §330.63(e)(5)(B(ii). See response to Comment T64.
T66	500	Part III	330.63(e)(5)(B)(ii)	Incomplete	See ID 498	Attachment 4, Appendix III-4.F and Attachment 5, Table 5-2-	This comment has been addressed, as provided in response to Comment T64.
T67	501	Part III	330.63(e)(5)(B)(iii)	Incomplete	See ID 497	Attachment 4, Appendix III-4.F and Attachment 5, Table 5-2-	This comment has been address, as provided in response to Comment T63.
T68	502	Part III	330.63(e)(5)(B)(iv)	Incomplete	See ID 497	Attachment 4, Appendix III-4.F and Attachment 5, Table 5-2-	This comment has been address, as provided in response to Comment T63.
T69	503	Part III	330.63(e)(5)(B)(v)	Incomplete	See ID 497	Attachment 4, Appendix III-4.F and Attachment 5, Table 5-2-	This comment has been address, as provided in response to Comment T63.
T70	504	Part III	330.63(e)(5)(C)	Inconsistent	See ID 494	Attachment 4, Figures 4.10 – 4.15	Added initial and current water levels to boring logs 1, 3, 18, 20, and 41 and cross-sections. Additionally, Table III-4.9 and 4.11, tables in Appendices III-4.K and 4.L, and graphs in Appendix III-4.J have been updated with recent water level data since the prior submittal.
NT71	505	Part III	330.63(e)(5)(D)	Incomplete	Provide separate potentiometric surface maps for the upper and lower wells and VMPs. Include date of GW readings.	Attachment 4, Figures 4.18 and 4.19	Separate potentiometric maps for upper and lower wells/vwp's have been provided. Note, we have added a new Figure 4.18, and adjusted all subsequent figure numbers, as shown in the TOC of Attachment 4.
NT72	509	Part III	330.63(f)(1)	Incomplete	List both well names in well pair locations.	Attachment 4, Figure 4.20	Added both well names at well locations on Figure 4.20.

NOD ID	MRI ID	App. Part	Citation	1st NOD Type	NOD Description	Response Location	Response
T73	514	Part III	330.63(f)(4)	Incomplete	Indicate distance between each point of compliance well on the map.	Attachment 4, Figure 4.20	Indicated distance between each point of compliance well on Proposed GWM System Map.
T74	514	Part III	330.63(f)(4)	Inconsistent	Revise Table III-4.14 to be consistent with Figure 4.19 showing which wells will be installed prior to landfill operation.	Attachment 4, Table III-4.14	Revised Table III-4.14 to be consistent with Figure 4.20.
T75	537	Part III	330.63(f)(5)(C)	Inconsistent	Indicate that if low-flow purging is used, low-flow sampling will also be used upon stabilization, if possible.	Attachment 7, Section 2.4.1.1	Low-flow sampling statement added per your request.
T76	558	Part III	330.403(a)(2)	Ambiguous	See ID 514	Attachment 4, Section 9.2	Clarified that the proposed monitoring wells will be installed prior to commencement of landfill operations.
T77	593	Part III	330.409(a)	Incomplete	Revise GWSAP, Section 4.5.6 to indicate that the LCL and UCL utilized will be the 95% limits.	Attachment 7, Section 4.5.6	Clarified that the 95% limits will be used for LCL and UCL.
T78	607	Part III	330.409(g)(1)(B)	Omitted	Include installation and sampling of adjacent wells in GWSAP text.	Attachment 7, Section 5.3	Comment was addressed as requested.
T79	619	Part III	330.409(i)	Incorrect	Revise GWSAP, Section 5.3 to discuss alternate GW protection standards, not alternate frequency as stated currently.	Attachment 7, Section 5.3	Comment was addressed as requested.
T80	623	Part III	330.409(k)(3)	Incomplete	Revise GWSAP, Section 5.5.3 to include GW flow rate & direction for both monitored aquifers.	Attachment 7, Section 5.5.3	Comment was addressed as requested.
T81	624	Part III	330.409(k)(4)	Incomplete	Revise GWSAP, Section 5.5.3 to include separate potentiometric surface maps for both monitored aquifers.	Attachment 7, Section 5.5.3	Comment was addressed as requested.
T82	641	Part III	330.421(a)(2)(B)	Incomplete	Indicate that no glue, solvents, field-cut slots, or filter cloths will be used.	Attachment 4, Section 9.2	Comment was addressed as requested.
NT83	647	Part III	330.421(a)(5)	Incomplete	Label barriers on Figure 4.20.	Attachment 4, Figure 4.21	Labelled barriers [aka bollards] on Figure 4.21.
NT84	648	Part III	330.421(b)	Omitted	Include acknowledgement.	Attachment 4, Section 9.2	Comment was addressed as requested.
NT85	658	Part III	330.371(c)-(1)	Ambiguous	Clarify or revise who or what is indicated by the term "residence" in the LGMP, Section 4.1.1.	Attachment 11, Section 4.1.1	Section 4.1.1 has been revised to replace the word "residence" with "landowner."
NT86	665	Part III	330.371(e)	Omitted	Include required statement.	Attachment 11, Section 3.3	Section 3.3 has been revised to include the required statement as requested.
T87	689	Part III	330.457(a)(3)	Incomplete	Provide a demonstration to show that the final cover top slopes will maintain erosional stability without a drainage layer.	Part III Narrative, Section 3.8.1, Attachment 9 Attachment 6C	The referenced narratives have been revised to include a single-sided geocomposite in the topslope final cover in response to this comment. Additionally, the topslope final cover detail on Drawing 6C.2 has been revised accordingly.
T88	694	Part III	330.457(e)(1)	Inconsistent	Geomembrane destructive seam testing is inconsistent with GRI GM-19a.	Attachment 9, Section 2.3.5 and Table 9-2-4	This comment has been addressed as requested. Additionally, we have corrected the ASTM test method reference.
NT89	723	Part III	330.463(a)(3)	Omitted	Include acknowledgement.	Attachment 9, Section 6.3	Section 6.3 of Attachment 9 has been revised to include the correct citation as 330.463(b)(2)(B).
NT90	738	Part III	330.503(a)	Incomplete	Include PE seal and signature on form TCEQ-20721.	Attachment 8, Appendix 8A	This comment has been addressed as requested.
NT91	797	Part IV	330.127(5)(D)	Incomplete	Include notification to local agencies as required in Section 5.3 and 5.5 of the SOP.	Part IV, Sections 5.3 and 5.5.	Sections 5.3 and 5.5 of the SOP have been amended to include a statement regarding notification to local agencies, in accordance with 330.127(5)(D).
NT92	834	Part IV	330.143(a)	Incomplete	Include that visibility of the benchmark will be maintained.	Section 4.7, SOP	Section 4.7 already includes the requirement to maintain visibility of the markers; however this section was revised to clearly clarify the referenced statement.
NT93	837	Part IV	330.143(b)	Incomplete	Include statement that ED may modify marker requirements.	Section 4.7, SOP	This comment has been addressed as requested.
NT94	911	Part IV	330.171(b)(1)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.
NT95	912	Part IV	330.171(b)(2)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.
NT96	913	Part IV	330.171(b)(2)(A)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.

NOD ID	MRI ID	App. Part	Citation	1st NOD Type	NOD Description	Response Location	Response
NT97	915	Part IV	330.171(b)(2)(C)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.
NT98	916	Part IV	330.171(b)(2)(D)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.
NT99	919	Part IV	330.171(b)(5)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.
NT100	920	Part IV	330.171(b)(6)	Omitted	Include required language.	Section 4.20, SOP	This comment has been addressed as requested.

TCEQ PART 1 FORM FOR NEW PERMIT FOR A MSW FACILITY (TCEQ-0650)

Facility Name: City of Waco Landfill
Permittee/Registrant Name: City of Waco
MSW Authorization #:2400
Initial Submittal Date: 8/7/2018
Revision Date: 10/6/2020

Texas Commission on Environmental Quality

Part I Form for New Permit/Registration and Amendment Applications for an MSW Facility

1. Reason for Submittal

☐ Initial Submittal ☒ Notice of Deficiency (NOD) Response

2. Authorization Type

☒ Permit ☐ Registration

3. Application Type

☒ New ☐ Major Amendment
☐ Major Amendment (Limited Scope)

4. Application Fees

☐ Pay by Check ☒ Online Payment

If paid online, e-Pay Confirmation Number: **582EA000311862**

5. Application URL

Is the application submitted for Type I Arid Exempt (AE) and/or Type IV AE facility?

☐ Yes ☒ No

If the answer is "No", provide the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted.
http://**http://www.waco-texas.com/landfill-application-process.asp**

6. Application Publishing

Party Responsible for Publishing Notice:

☐ Applicant ☐ Agent in Service ☒ Consultant

Contact Name: **Ryan R. Kuntz, P.E.** Title: **Vice President /Project Director**

7. Alternative Language Notice

Is an alternative language notice required for this application? (For determination refer to Alternative Language Checklist on the Public Notice Verification Form TCEQ-20244-Waste)

☐ Yes ☒ No

8. Public Place Location of Application

Name of the Public Place: **Waco-McLennan County Central Library**

Physical Address: **1717 Austin Avenue**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76701**

(Area code) Telephone Number: **254.750.5941**

9. Consolidated Permit Processing

Is this submittal part of a consolidated permit processing request, in accordance with 30 TAC Chapter 33?

☐ Yes ☒ No ☐ Not Applicable

If "Yes", state the other TCEQ program authorizations requested:

10. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

11. Permits and Construction Approvals

Permit or Approval	Received	Pending	Not Applicable
Hazardous Waste Management Program under the Texas Solid Waste Disposal Act	☐	☐	☒
Underground Injection Control Program under the Texas Injection Well Act	☐	☐	☒
National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26	☐	☒	☐
Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA). Nonattainment Program under the FCAA	☐	☐	☒
National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA	☐	☐	☒
Ocean Dumping Permits under the Marine Protection Research and Sanctuaries Act	☐	☐	☒

Permit or Approval	Received	Pending	Not Applicable
Dredge or Fill Permits under the CWA	☐	☐	☒
Licenses under the Texas Radiation Control Act	☐	☐	☒
Other (describe)	☐	☐	☐
Other (describe)	☐	☐	☐
Other (describe)	☐	☐	☐
Other (describe)	☐	☐	☐

12. General Facility Information

Facility Name: **City of Waco Landfill**

Contact Name: **Charles Dowdell** Title: **Director of Solid Waste**

MSW Authorization No. (if available): **2400**

Regulated Entity Reference No. (if issued)*: RN**110471307**

Physical or Street Address (if available): **4730 T K Parkway**

City: **Axtell** County: **McLennan & Limestone** State: **TX** Zip Code: **76624**

(Area Code) Telephone Number: **(254) 750-1601**

Latitude (Degrees, Minutes Seconds): **N 31° 42' 05.31"**

Longitude (Degrees, Minutes Seconds): **W 96° 55' 52.07"**

Benchmark Elevation (above mean sea level): ft.

Provide a description of the location of the facility with respect to known or easily identifiable landmarks: **approximately 0.4 mile south of the intersection of TK Parkway and State Highway 31 in McLennan County**

Detail access routes from the nearest United States or state highway to the facility: **approximately 0.4 mile south of the intersection of TK Parkway and State Highway 31 in McLennan County**

*If this number has not been issued for the facility, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Facility as the Regulated Entity.

13. Facility Type(s)

☒ Type I ☐ Type IV ☐ Type V

☐ Type I AE ☐ Type IV AE ☐ Type VI

14. Activities Conducted at the Facility

☐ Storage ☐ Processing ☒ Disposal

15. Facility Waste Management Unit(s)

- ☒ Landfill Unit(s)
- ☐ Class 1 Landfill Unit(s)
- ☐ Process Tank(s)
- ☐ Storage Tank(s)
- ☐ Tipping Floor
- ☐ Storage Area
- ☐ Container(s)
- ☐ Roll-off Boxes
- ☐ Surface Impoundment
- ☐ Incinerator(s)
- ☐ Autoclave(s)
- ☐ Refrigeration Unit(s)
- ☐ Mobile Processing Unit(s)
- ☐ Type VI Demonstration Unit
- ☐ Compost Pile(s) and/or Vessel(s)
- ☐ Other (Specify)
- ☐ Other (Specify)
- ☐ Other (Specify)

16. Description of Proposed Facility or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or permit conditions if the application is for an amendment.

Proposed Type I Municipal Solid Waste Landfill located on 502.5 acres of land in McLennan and Limestone Counties, designed in accordance with Title 30, Texas Administrative Code, Chapter 330. The primary purpose of this landfill is to serve as a replacement for the current City of Waco landfill (MSW Permit No. 948A). The landfill will provide disposal capacity for residences, businesses, and industries primarily in the communities of McLennan and Limestone Counties and other nearby counties. Includes submittal of Parts III and IV of the permit application, and responses to technical notice of deficiency letters dated 11/19/18, 2/14/19, and 8/19/2020.

17. Facility Contact Information

Site Operator (Permittee/Registrant) Name: City of Waco

Customer Reference No. (if issued)*: CN**600131940**

Contact Name: **Charles Dowdell** Title: **Director of Solid Waste**

Mailing Address: **501 Schroeder Drive**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76710**

(Area Code) Telephone Number: **(254) 750-1601**

Email Address: **charlesd@wacotx.gov**

TX Secretary of State (SOS) Filing Number:

*If the Site Operator (Permittee/Registrant) does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Site Operator (Permittee/Registrant) as the Customer.

Operator Name[1]: same as Permittee

Customer Reference No. (if issued)*:

Contact Name: Title:

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address:

TX SOS Filing Number:

[1]If the Operator is the same as Site Operator/Permittee type "Same as "Site Operator (Permittee/Registrant)".
*If the Operator does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Operator as the customer.

Consultant Name (if applicable): SCS Engineers, TBPE Registration No. F-3407

Texas Board of Professional Engineers Firm Registration Number:

Contact Name: **Ryan R. Kuntz, P.E.** Title: **Vice Pres., Pr. Director**

Mailing Address: **1901 Central Drive, Suite 550**

City: **Bedford** County: **Tarrant** State: **TX** Zip Code: **76021**

(Area Code) Telephone Number: **817.358.6117**

E-Mail Address: **rkuntz@scsengineers.com**

Agent in Service Name (required only for out-of-state):

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

E-Mail Address:

18. Facility Supervisor's License

Select the Type of License that the Solid Waste Facility Supervisor, as defined in 30 TAC Chapter 30, Occupational Licenses and Registrations, will obtain prior to commencing facility operations.

☒ Class A ☐ Class B

19. Ownership Status of the Facility

☐ Corporation	☐ Limited Partnership	☐ Federal Government
☐ Individual	☒ City Government	☐ Other Government
☐ Sole Proprietorship	☐ County Government	☐ Military
☐ General Partnership	☐ State Government	☐ Other (Specify):

Does the Site Operator (Permittee/Registrant) own all the facility units and all the facility property?

☒ Yes ☐ No

If “No”, provide the information requested below for any additional ownership.

Owner Name:

Street or P.O. Box:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

20. Other Governmental Entities Information

Texas Department of Transportation District: Waco

District Engineer’s Name: **Stanley Swiatek, P.E.**

Street Address or P.O. Box: **100 S. Loop Drive**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76704-2858**

(Area Code) Telephone Number: **(254) 867-2700**

E-Mail Address (optional):

The Local Governmental Authority Responsible for Road Maintenance (if applicable): N.A.

Contact Person’s Name:

Street Address or P.O. Box:

City: County: State: Zip Code:

(Area Code) Telephone Number:

E-Mail Address (optional):

City Mayor Information

City Mayor’s Name: **Kyle Deaver**

Office Address: **300 Austin Ave**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76702**

(Area Code) Telephone Number: **(254) 750-5750**

E-Mail Address (optional): **kyle.deaver@wcotx.gov**

City Health Authority: Waco-McLennan County Public Health District

Contact Person’s Name: **Dr. Brenda Gray, Director**

Street Address or P.O. Box: **225 W. Waco Drive**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76707**

(Area Code) Telephone Number: **(254) 750-5450**

E-Mail Address (optional):

County Judge Information

County Judge's Name: **Scott M. Felton**

Street Address or P.O. Box: **501 Washington Ave, Room 214**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76701**

(Area Code) Telephone Number: **(254) 757-5049**

E-Mail Address (optional):

County Health Authority: Waco-McLennan County Public Health District

Contact Person's Name: **E. Farley Verner, M.D.**

Street Address or P.O. Box: **7030 New Sanger Road, Suite 202**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76712**

(Area Code) Telephone Number: **(254) 855-9790**

E-Mail Address (optional): **farleyverner@gmail.com**

State Representative Information

District Number: **12**

State Representative's Name: **Kyle Kacal**

District Office Address: **3000 Briarcrest Dr., Ste 203**

City: **Bryan** County: **Brazos** State: **TX** Zip Code: **77802**

(Area Code) Telephone Number: **979-774-7276**

E-Mail Address (optional):

State Senator Information

District Number: **22**

State Senator's Name: **The Honorable Brian Birdwell**

District Office Address: **900 Austin Ave, Suite 500**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76701**

(Area Code) Telephone Number: **(254) 772-6225**

E-Mail Address (optional):

Council of Government (COG) Name: Heart of Texas

COG Representative's Name: **Falen Bohannon**

COG Representative's Title: **Solid Waste Program Manager**

Street Address or P.O. Box: **1514 S. New Road**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76711**

(Area Code) Telephone Number: **(254)292-1800**

E-Mail Address (optional): **Falen.Bohannon@hot.cog.tx.us**

County Judge Information

County Judge's Name: **Limestone County Judge: Honorable Richard Duncan**

Street Address or P.O. Box: **200 W. State ST., Ste 101**

City: **Groesbeck** County: **Limestone** State: **TX** Zip Code: **76642**

(Area Code) Telephone Number: **254-729-3810**

E-Mail Address (optional):

County Health Authority: Limestone Medical Center

Contact Person's Name: **Dr. Jeffrey Rettig**

Street Address or P.O. Box: **204 W. Trinity Street**

City: **Groesbeck** County: **Limestone** State: **TX** Zip Code: **76642**

(Area Code) Telephone Number: **254-729-3740**

E-Mail Address (optional):

State Representative Information

District Number: **12**

State Representative's Name: **Kyle Kacal**

District Office Address: **3000 Briarcrest Dr., Ste 203**

City: **Bryan** County: **Brazos** State: **TX** Zip Code: **77802**

(Area Code) Telephone Number: **979-774-7276**

E-Mail Address (optional):

State Senator Information

District Number: **5**

State Senator's Name: **Charles Schwertner**

District Office Address: **3000 Briarcrest Drive, Suite 202**

City: **Bryan** County: **Brazos** State: **TX** Zip Code: **77802**

(Area Code) Telephone Number: **979-776-0222**

E-Mail Address (optional):

Council of Government (COG) Name: Heart of Texas

COG Representative's Name: **Falen Bohannon**

COG Representative's Title: **Solid Waste Program Manager**

Street Address or P.O. Box: **1514 S. New Road**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76711**

(Area Code) Telephone Number: **(254)292-1800**

E-Mail Address (optional): **Falen.Bohannon@hot.cog.tx.us**

River Basin Authority Name: Brazos River Authority

Contact Person's Name: **Phil Ford**

Watershed Sub-Basin Name:

Street Address or P.O. Box: **4600 Cobbs Drive**

City: **Waco** County: **McLennan** State: **TX** Zip Code: **76710**

(Area Code) Telephone Number: **(888) 922-6272**

E-Mail Address (optional):

Coastal Management Program

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

U.S. Army Corps of Engineers

The facility is located in the following District of the U.S. Army Corps of Engineers:

☐ Albuquerque, NM ☐ Galveston, TX

☒ Ft. Worth, TX ☐ Tulsa, OK

Local Government Jurisdiction

Within City Limits of:

Within Extraterritorial Jurisdiction of:

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ☒ No

(If "Yes", provide a copy of the ordinance or order as an attachment):

Signature Page

I, Bradley Ford, City Manager,
(Site Operator (Permittee/Registrant)'s Authorized Signatory) (Title)

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: ____________ Date: 10-07-20

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, ____________, hereby designate ____________
(Print or Type Operator Name) (Print or Type Representative Name)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

____
Printed or Typed Name of Operator or Principal Executive Officer

____
Signature

SUBSCRIBED AND SWORN to before me by the said Bradley Ford

On this 7th day of October, 2020

My commission expires on the 31st day of March 2022

Nita H Mays

Notary Public in and for

McLennan County, Texas

(Note: Application Must Bear Signature & Seal of Notary Public)

NITA H MAYS
Notary Public, State of Texas
Comm. Expires 03-31-2022
Notary ID 1117522-0

Part I Attachments

(See Instructions for P.E. seal requirements.)

Required Attachments	**Attachment No.**
Supplementary Technical Report	X
Property Legal Description	X
Property Metes and Bounds Description	X
Facility Legal Description	X
Facility Metes and Bounds Description	X
Metes and Bounds Drawings	X
On-Site Easements Drawing	X
Land Ownership Map	X
Land Ownership List	X
Electronic List or Mailing Labels	X
Texas Department of Transportation (TxDOT) County Map	X
General Location Map	X
General Topographic Map	X
Verification of Legal Status	X
Property Owner Affidavit	X
Evidence of Competency	X
Additional Attachments as Applicable- Select all those apply and add as necessary	
☒ TCEQ Core Data Form(s)	X
☒ Signatory Authority Delegation	X
☒ Fee Payment Receipt	X
☐ Confidential Documents	
☐ Waste Storage, Processing and Disposal Ordinances	
☐ Final Plat Record of Property	
☐ Certificate of Fact (Certificate of Incorporation)	
☐ Assumed Name Certificate	

CITY OF WACO LANDFILL
TCEQ PERMIT NO. MSW-2400
McLENNAN AND LIMESTONE COUNTIES, TEXAS

PARTS I/II
GENERAL APPLICATION REQUIREMENTS

Prepared for:

CITY OF WACO

Solid Waste Services
501 Schroeder Drive
Waco, TX 76710

STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED
PROFESSIONAL ENGINEER
10/6/2020

Prepared by:

SCS ENGINEERS
Texas Board of Professional Engineers, Reg. No. F-3407
Dallas/Fort Worth Office
1901 Central Drive, Suite 550
Bedford, Texas 76021
817/571-2288

Revision 0 - August 2018, September 2018 (Admin NOD #1)
Revision 1 – January 2019
Revision 2 – March 2019
Revision 3 – October 2020
SCS Project No. 16216088.00

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STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED
PROFESSIONAL ENGINEER
10/6/2020

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SCS Engineers
TBPE Reg. # F-3407

2 GENERAL INFORMATION

2.1 PROJECT OVERVIEW

The proposed landfill will be a Type I MSW landfill with a permit boundary of 502.5 acres. The waste disposal footprint will encompass 173.8 acres, separated into two (2) disposal areas, with the East Disposal Area comprised of 112.2 acres and West Disposal Area comprised of 61.6 acres, as shown on Drawing I/II-5 – Facility Layout Plan. The landfill will serve residences, businesses, and industries in the communities of McLennan and Limestone County and other nearby counties transported to the landfill by municipal, private, and public haulers. The landfill will accept waste as defined in Section 2.2.2, including municipal solid waste, Class 2 and Class 3 non-hazardous industrial wastes, and special wastes authorized by the TCEQ.

This permit application includes the TCEQ required information, in accordance with 30 TAC Chapter 330. The proposed landfill is consistent with the region's waste capacity needs, as noted by the Heart of Texas Council of Governments (HOTCOG) (see Appendix I/IIA for documentation of coordination with HOTCOG).

2.2 WASTE ACCEPTANCE PLAN (30 TAC §330.61(B))

2.2.1 Disposal Rate and Volume of Waste

This landfill is intended to serve a similar customer base as the City of Waco's current landfill (referred to as Site 948A, based on its Permit No. MSW-948A). As indicated in Site 948A's fiscal year 2017 Annual Report to the TCEQ, the remaining life for Site 948A is estimated to be 6.9 years as of September 2017. While the City of Waco expects to continue its recycling and waste diversion programs, it is conservatively estimated that this proposed landfill's waste acceptance rate will continue to increase consistent with the population growth in McLennan County. As described in Appendix I/IIC – Land-Use Analysis, growth trends in McLennan County have increased by 1.25% on average between 2010 through 2016. As such, assuming this continued population growth trend, it is anticipated that the proposed landfill will receive approximately 305,000 tons of solid waste per year in its initial year of operation, estimated to be 2024. This translates to an initial disposal rate of approximately 1,070 tons per day over a 286 day per year operating schedule. Assuming that the waste inflow volume will continue to increase at this same growth rate, the expected maximum annual waste acceptance rate is estimated to be approximately 325,000 tons per year after a five-year period of operation, which translates to a disposal rate of approximately 1,140 tons per day over a 286 day per year operating schedule. The above projections are based on current market conditions, and may vary as market conditions and recycling and waste diversion practices change.

Over the life of the landfill, it is anticipated that the population served by the landfill will change as warranted by the needs of the area and market conditions. Based on an estimated 6.7 pounds of waste generated daily per person (ref: HOTCOG Regional Solid Waste Plan, 2013 Update), assuming an initial disposal rate of 1,070 tons per day, the number of people served by the landfill will be approximately 319,000 persons. Based on the maximum acceptance rate of 1,140 tons per day after a five-year period of operation, the number of people served by the landfill will be approximately 340,000 persons.

2.2.2 Properties and Characteristics of Waste

The major classifications of solid waste to be accepted at the landfill include household waste, yard waste, commercial waste, Class 2 and Class 3 non-hazardous industrial wastes, construction-demolition waste, and special wastes. Each classification of waste is defined in 30 TAC §330.3 and summarized below:

- **Household Waste:** Any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels, motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas) and does not include yard waste or brush that is completely free of any household wastes.

- **Yard Waste:** Yard waste includes leaves, grass clippings, yard and garden debris, and brush, including clean woody vegetative material not greater than 6 inches in diameter that results from landscaping maintenance and land-clearing operations. The term does not include stumps, roots, or shrubs with intact root balls.

- **Commercial Waste:** Solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential and industrial wastes.

- **Class 2 and Class 3 Industrial Waste (Nonhazardous):** Solid waste resulting from or incidental to any process of industry or manufacturing, mining or agricultural operations, classified as follows:

    - Class 2 Industrial Solid Waste - any individual solid waste or combination of industrial solid wastes that cannot be described as Class 1 or Class 3, as defined in 30 TAC §335.506 (relating to Class 2 waste determination).

    - Class 3 Industrial Solid Waste – any inert and essentially insoluble industrial solid waste, including materials such as rock, brick, glass, dirt, and certain plastics and rubber, etc., that are not readily decomposable as defined in 30 TAC §335.507 (relating to Class 3 waste determination).

- **Construction-Demolition Waste**: Waste resulting from construction or demolition projects; includes all materials that are directly or indirectly the by-products of construction work or that result from demolition of buildings and other structures, including, but not limited to, paper, cartons, gypsum board, wood, excelsior, rubber, and plastics.

- **Special Wastes:** Any solid waste or combination of solid wastes that because of its quantity, concentration, physical or chemical characteristics, or biological properties requires special handling and disposal to protect human health or the environment. If improperly handled, transported, stored, processed, or disposed of, or otherwise managed, it may pose a present or potential danger to human health or the environment.

Any special waste accepted at the landfill will be in accordance with 30 TAC §330.171. Consistent with 30 TAC §330.15(e) the facility will not accept regulated hazardous waste, polychlorinated biphenyls (PCBs), and all other prohibited waste defined therein. Additionally, Class I industrial solid waste will not be accepted at this facility.

2.3 EASEMENTS AND BUFFER ZONES

2.3.1 Easement Protection (30 TAC §330.543(a))

Easements are described in Section 3 and shown on the metes and bound survey in Section 14, Attachment 14A. At the time of landfill development or cell construction, the waste disposal footprint will be located at least 25-feet from the centerline of the utility and pipeline easements, but no closer than the easement boundary, consistent with 30 TAC §330.543(a). All pipeline and utility easements shall be clearly marked with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet. No solid waste unloading, storage, disposal, or processing operations will occur within any easement or right-of-way that crosses the facility, unless and until the easement has been abandoned or relocated.

2.3.2 Buffer Zones (30 TAC §330.543(b))

The Site will be developed with buffer zones of at least 125 feet between areas of solid waste disposal, storage, and processing (e.g. Type I waste disposal units, citizen's convenience center, etc.) and the permit boundary in accordance with 30 TAC §330.543(b)(2)(A). Buffer zones for the Site are depicted on Drawing I/II-5, which are greater than or equal to 125 feet. Access roads are provided in the buffer zones, which provide for safe passage for firefighting and other emergency vehicles. No solid waste unloading, storage, disposal, or processing operations will occur within any buffer zone.

2.4 AGENCY COORDINATION

Documentation of coordination with the following agencies is included in Appendix I/IIA.

- Texas Parks and Wildlife Department
- U.S. Department of the Interior, Fish and Wildlife Service
- Texas Historic Commission
- Texas Department of Transportation
- Heart of Texas Council of Governments (HOTCOG)
- Federal Aviation Administration
- U.S. Army Corps of Engineers

3 EXISTING CONDITIONS SUMMARY (30 TAC §330.61(a))

The existing site conditions are generally depicted on Drawing I/II-2 – General Topographic Map. The proposed landfill will be located on a 502.5-acre property (referred to herein as "the Site") that is located approximately 0.4 mile south of the intersection of State Highway 31 and FM 939 (see Drawing I/II-1). The Site, which is located in both McLennan and Limestone Counties, is currently comprised of rural native pasture land. The Site is relatively flat, and slopes gently to the center of the site towards Horse Creek. Surface water generally drains southeast from the western portion of the Site towards Horse Creek and generally drains south/southwest from the eastern portion of the Site towards Horse Creek and Packwood Creek. These creeks are tributaries of Soil Conservation Services Site 19 Reservoir, which discharges into Williams Creek located south of the Site and eventually flows into Tehuacana Creek about 11 miles southwest of the Site.

A portion of the Site is located in the 100-year floodplain, as described in Section 11.1. The waste disposal footprint is located entirely outside the limits of the 100-year floodplain (see Drawing I/II-5).

There are three (3) known easements on the Site, including a flowage, waterline, and electric line easement, as shown on the metes and bound survey in Section 14, Attachment 14A. The flowage easement is under the jurisdiction of the Tehuacana Creek Water Control and Improvement District Number One (1) of Leroy, Texas. No waste is proposed to be placed in the flowage easement. There is also a 20-foot electric line easement and 15-foot waterline easement on the property on the west side of the property. No waste is proposed to be placed in either the electric line easement or the waterline easement. All easements and associated deed records are further identified on the metes and bound survey provided in Section 14, Attachment 14A.

5 LANDOWNERS' MAP AND LIST

In accordance with 30 TAC §330.59(c)(3)(B) and §305.45(a)(6)(D), the landowners' list presents the names and mailing addresses of the landowners of property within one-quarter (1/4) mile of the Site, as provided in Table 5-1. The numbering in the landowners list corresponds to the numbers on Drawing I/II-3, which depicts the locations of the landowners. The landowners' list and map are based on the McLennan, Limestone, and Hill County Appraisal Districts' property records, as of April 2018. Additionally, mineral interest owners shown in Table 5-2 were identified in the real property records for McLennan and Limestone Counties as provided by the Title company. Neither McLennan nor Limestone Counties identify mineral interests in their real property appraisal records.

Table 5-1 Landowners

1.	City of Waco 300 Austin Avenue Waco, TX 76702	7.	Te Kay Ranch*	13.	Confidential Owner – Prop ID 352815 4396 TK Pkwy Axtell, TX 76624
2.	City of Waco 300 Austin Avenue Waco, TX 76702	8.	Lee Mike Rex et al 3096 Happy Swaner Ln Axtell, TX 76624	14.	Rigby Steven William & Elisabeth Anne 4070 TK Pkwy Axtell, TX 76624
3.	Dunlap Billie J 536 St Hwy 31 Mt. Calm, TX 76673	9.	Swaner Fred Lee Jr 4351 TK Pkwy Axtell, TX 76624	15.	Reed David L 3444 TK Pkwy Axtell, TX 76624
4.	Dunlap Joe W & Cynthia 211 State Hwy 31 Mt. Calm, TX 76673	10.	JWL Interests LLC - Series Ranch 1 3132 Lovers Lane Dallas, TX 75225	16.	Jameson Mary Jo Grubbs Trustee et al 1910 Channing Park Dr Arlington TX 76013
5.	Trayler James F 796 LCR 114 Waco, TX 76705	11.	City of Waco 300 Austin Avenue Waco, TX 76702	17.	Coggin Mary Ruth 532 LCR 112 Axtell, TX 76624
6.	Unknown Right-of-Way Ownership*	12.	Powser Victoria & Cody 4418 TK Pkwy Axtell, TX 76624		

*No information available per Kevin Fikes at the McLennan County Appraisal District

Table 5-2 Mineral Interest Owners

Joe Thompson*	St. Louis Southwestern Railway Company*	Jim B. Horn Rt. 1, Box 60 Axtell, TX 76624
Tant Horn 609 Norma Waco, TX 76705	Union Pacific Railroad Company*	Ridley and Locklin*
Sun Oil Company*	Paul Barenkamp 8233 Purdue Tyler, TX 75701	St. Louis Southwestern Railway Company*

*No address available in lease summaries.

8 TRANSPORTATION (30 TAC §330.61(i))

8.1 TRAFFIC INFORMATION

The proposed landfill will be located on FM 939, also known as T K Parkway. The primary access route to the landfill will be via State Highway (SH) 31 and FM 939. Currently, FM 939 is a two-lane asphalt-paved road. SH 31 is a concrete-paved four-lane divided highway that connects the City of Waco to FM 939. The landfill entrance will be located approximately 0.4 mile south of the intersection of SH 31 and FM 939. The proposed access roads for the landfill within a one-mile radius are depicted on Drawing I/II-1 – Site Location Map. Confirmation of coordination with the Texas Department of Transportation (TxDOT), Waco District, is included in Appendix I/IIA.

According to the 2016 Waco District Traffic Map, the traffic counts on FM 939 adjacent to the proposed landfill entrance were 607 vehicles per day. Additionally, according to the same traffic map, traffic counts for SH 31 were 6,063 vehicles per day near the intersection of FM 939 and SH 31, approximately 0.4 mile north of the proposed landfill entrance. The 2016 Waco District Traffic Map is provided in Appendix I/IID-1.

A Traffic Impact Analysis (TIA) for the proposed site has been prepared by Lee Engineering, and is provided in Appendix I/IID-2. Based on the TIA, the maximum initial increase in vehicle traffic on FM 939 and SH 31 associated with the landfill is estimated to be 442 vehicles per day (884 vehicle trips per day, including employee vehicle trips). Assuming that the waste inflow volume will continue to increase in accordance with growth trends in McLennan County (i.e., 1.25% as provided in Appendix I/IIC), the total vehicle traffic on FM 939 and SH 31 associated with the landfill is estimated to increase to 679 vehicles per day (1,358 vehicle trips per day, including employee vehicle trips) over the life of the landfill. This may include transfer trucks, collection trucks and small vehicles, as well as landfill employee vehicles. This estimated increase in traffic is dependent on the method of waste transport (i.e., direct haul vs. use of transfer trailers), the use of the landfill by small vehicles, as well as market dynamics of the waste collection and hauling business. The following information is concluded or stated in the TIA:

- Adequate capacity for the surrounding roadways will be available to serve the additional traffic generated by the future operations of the proposed MSW facility along with assumed background growth.
- Area intersections are anticipated to operate at acceptable levels of service for predicted background and total traffic operations in 2024 through 2059.

Although the following improvements are not necessary for the surrounding roadways and intersections to serve the traffic to be generated by the landfill, to improve traffic safety, the City of Waco is funding the following improvements to FM 939, to be constructed by TxDOT in conjunction with the construction of an overpass at the intersection of SH 31 and FM 939, with an anticipated completion date of April, 2022, as stated in the March 25, 2020 letter from TxDOT (see Appendix I/IIA); prior to the anticipated opening of the landfill in 2024:

- A structural overlay on FM 939 between SH 31 and the landfill entrance;

- Adding eight-foot shoulders on both sides of FM 939 between SH 31 and the landfill entrance;
- Adding a southbound left-turn lane for vehicles entering the facility entrance; and
- Adding a northbound right-turn lane for vehicles entering the facility entrance.

The City is not planning to construct a westbound acceleration lane and yellow/red flashing beacons and intersection illumination on SH 31 (as discussed in the TIA) because they are not needed, and even if installed, would be removed when TxDOT constructs the overpass discussed above. Coordination with TxDOT, Waco District, related to review and approval of the TIA, dated March 25, 2020, is included in Appendix I/IIA.

8.2 AIRPORTS (30 TAC §330.619(C)(8) & §330.545)

There are no airports as defined by 30 TAC § 330.3(5) located within a six mile radius of the landfill, as depicted on Drawing I/II-1. Coordination with the FAA is included in Appendix I/IIA. Based on the FAA's response to this coordination, the FAA has no objection to the proposed Type I landfill (see Appendix I/IIA).

9 GENERAL GEOLOGY AND SOILS STATEMENT (30 TAC §330.61(i))

9.1 REGIONAL GEOLOGIC SETTING

The Site is located in the Blackland Prairie subdivision of the Coastal Plain physiographic province. Soils derived from the underlying formation generally are low hydraulic conductivity geologic formations and are typically dark, clay-rich, and drain slowly.

The Site is primarily situated on the outcrop of the Wolfe City Formation, a Cretaceous age calcareous clay/marl/sand/shale. The Wolfe City Formation is described by the *Geologic Atlas of Texas, Waco Sheet* (1970) as:

> *Marl, sand, sandstone, and clay; marl, sandy, silty, dark gray to light gray and brown, interbedded with, thin sandstone lenses cemented by sparry fine to coarse grained calcite, grain size increases northward; uncemented sand increases northward; clay; glauconitic, phosphate and hematite nodules, dark gray to brown; thickness up to 300 feet, feathers out near southern edge of sheet.*

9.2 SITE GEOLOGY

Site geologic conditions encountered in field investigations were consistent with the Wolfe City Formation descriptions in relevant literature. Site geology is characterized by three units as follows, from the ground surface downward to a maximum drilled depth of 150 feet.

- Unit 1: Overlying soil horizon, light brown to dark brown, soft, clay.
- Unit 2: Hard, brown to mottled grey, high plasticity, calcareous, fossil-bearing clay, with minor amounts of dark gray to brown, very fine-grained sand. The contact with the underlying unweathered shale (see below) is marked by a clear color change from lighter colors in Unit 2 to dark gray and black in Unit 3.
- Unit 3: Hard, unweathered, dark gray to black, fossil bearing shale with small 1/8" to 1/2" lenses of sand and limestone (to bottom of borings).

Based on available information, including field investigation of the Site, the geology of the Site is considered suitable for landfill development.

9.3 ON-SITE SOILS

The Site is located in Limestone and McLennan counties and is composed of 11 soil types. The majority of the Site consists of Wilson clay loam, which consists of very deep, moderately well drained, very slowly permeable soils found on stream terraces and Axtell fine sandy loam, which consists of very deep, moderately well drained, very slowly permeable soils found on broad river terraces. Following are detailed results from the two County soil reports:

- Natural Resource Conservation Service's Soil Geographic Database for Limestone County: Axtell fine sandy loam, Ferris clay, Ferris-Heiden complex, Heiden clay, Houston Black clay, Tinn clay, and Wilson clay loam.

- Natural Resource Conservation Service's Soil Geographic Database for McLennan County: Crockett loam, Heiden clay, and Wilson clay loam.

9.4 FAULT AREAS

The proposed Site was reviewed for the presence of faulting in accordance with 30 TAC §330.555 criteria by a professional geologist licensed in the State of Texas. The study included review of aerial photographs and a search of relevant geophysical literature for this area, consistent with criteria defined in 30 TAC §330.555(b) (1) – (12). No evidence was found for any fault within 200 feet of the Site boundary having displacement within Holocene time, as shown on Drawing I/II-6 - Regional Tectonic/Geology Map. Therefore, the landfill is in compliance with the Fault Areas Restrictions stated in 30 TAC §330.555.

Fault evaluation conducted by SCS Engineers included:

1. Review of published geologic maps.
2. Review of published surficial fault maps.
3. Review of aerial photographs.
4. Field inspection for fault indications/surface displacement.

9.5 SEISMIC IMPACT ZONES

The location restriction criterion in 30 TAC §330.557 requires that new disposal units and lateral expansions not be located in seismic impact zones unless the owner or operator can demonstrate that all containment structures, including liners, leachate collection systems, and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the landfill. A seismic impact zone is defined as an area with a 10 percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 250 years. If the maximum horizontal acceleration is less than or equal to 0.10 g, then the design of the unit will not need to incorporate an evaluation of seismic effects.

Areas within the United States where seismic effects need to be evaluated, as determined by the United States Geological Survey (USGS), are shown on Drawing I/II-7 – Seismic Impact Map. As indicated on this drawing, the landfill property is not located within a seismic impact zone as defined by 30 TAC §330.557. Therefore, an evaluation of the seismic effects on the landfill design is not required for this landfill.

9.6 UNSTABLE AREAS

The location restriction criteria in 30 TAC §330.559 require engineering measures to be incorporated into the design of a disposal unit located in an unstable area to ensure that the integrity of the structural components of the disposal unit will not be disrupted. Unstable areas, by definition, are areas susceptible to natural or human-induced events or forces that are capable of impairing the integrity of some or all structural components (i.e., liners, leachate collection systems, final covers, etc.) of a disposal unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movement, salt domes, or karst terrain.

Based on information from existing geological and geotechnical data (reference: Bureau of Economic Geology, University of Texas at Austin), unstable areas due to poor foundation conditions, areas susceptible to mass movement, salt domes, or karst terrain do not exist at, or immediately adjacent to the Site. Therefore, additional engineering measures for unstable areas do not need to be incorporated into the design of the landfill. This determination was made based on (1) none of the geological or geotechnical literature reviewed stated that the Wolfe City formation creates unstable areas, and (2) field observations made by experienced, certified professionals did not indicate the existence of unstable areas within the Site. Further information and documentation related to unstable areas is provided in Part III of the application.

and eventually flows into Tehuacana Creek approximately 11 miles southwest of the property. Tehuacana Creek discharges into the Brazos River approximately 15 miles southwest of the property.

Liquids resulting from the operation of the landfill will be disposed of in a manner that will not cause adverse impacts to surface water. The landfill is being designed to prevent discharge of pollutants into waters of the State or waters of the United States, as defined by the Texas Water Code and the Federal Clean Water Act, §402, as amended, respectively. Consistent with TCEQ requirements, a Notice of Intent (NOI) will be submitted to the TCEQ and a Stormwater Pollution Prevention Plan will be developed prior to the commencement of landfill operations to obtain coverage under the Texas Pollutant Discharge Elimination System (TPDES) General Permit, TXR050000 for Stormwater Discharges associated with Industrial Activity. In addition, an NOI will be submitted to the TCEQ and a Stormwater Pollution Prevention Plan will be developed prior to construction to obtain coverage under the TPDES General Permit, TXR150000 for Stormwater Discharges Associated with Construction Activity.

The City will obtain appropriate approvals or permits that may be required by local agencies for connection to a sanitary sewer or installation of an on-site domestic wastewater management system.

For these reasons, the use of the site as a landfill is a compatible land-use with the Soil Conservation Services Site 19 Reservoir.

11 FLOODPLAIN AND WETLANDS STATEMENT (30 TAC §330.61(m))

11.1 FLOODPLAIN STATEMENT

A small portion of the Site is within the 100-year floodplain of Horse and Packwood Creeks as defined by FEMA. The floodplain limits were obtained from the current effective Flood Insurance Rate Maps (Panels 48309C0250D and 48293C0125C) obtained from FEMA for portions of McLennan and Limestone County. The floodplain limits have been established as Zone A which indicates that no flood elevations have yet been determined along these creeks on the Site. The 100-year floodplain is shown on Drawings I/II-2, I/II-4, and I/II-5.

The proposed waste disposal footprint is located entirely outside the limits of the 100-year floodplain as defined by FEMA. In accordance with 30 TAC §330.547(a), no solid waste disposal operations will take place within the 100-year floodplain, and therefore no development is proposed in the 100-year floodplain. As such, no levee or other flood protection improvement is proposed. Additionally, in accordance with 30 TAC §330.547(b), site operations and development will not restrict the flow or reduce the temporary storage capacity of the 100-year floodplain; nor will the site operations result in washout of solid waste associated with the 100-year floodplain. Furthermore, in accordance with 30 TAC §330.547(c), all storage and processing facilities (e.g., onsite citizen's convenience center) will be located outside of the 100-year floodplain.

Additionally, the site will not require any levees or other improvements, including channel improvements, drainage works, or other projects on, along, or near any stream in the state that is subject to floods, freshets, or overflows, constructed so as to control, regulate, or otherwise change the floodwater of the stream. No portions of the landfill are located within a 100-year floodway. Therefore, the requirements of 30 TAC Chapter 301, Subchapter C, §301.31 to 301.46 relating to the Approval of Levees and Other Improvements, as referenced in 30 TAC §330.61(m)(1) and §330.63(c)(2)(D)(i), are not applicable.

Furthermore, as discussed in Part III, Attachment 6B, a site specific study of the 24-hour, 100-year storm event was performed. The proposed waste disposal footprint is completely outside of the area shown to be impacted by the 24-hour, 100-year storm event. Further, no waste processing is proposed in the area shown to be impacted by the 24-hour, 100-year storm event.

11.2 WETLANDS STATEMENT

See Appendix I/IIA for the coordination letter with the U.S. Army Corps of Engineers, and Section 404 Jurisdiction Determination report by C. Lee Sherrod of Horizon Environmental Services in Appendix I/IIE, which addresses the pertinent TCEQ regulations (30 §TAC 330.61(m)(2)) regarding wetlands. As noted in the coordination letter in Appendix I/IIA, "No wetlands will be impacted by the proposed landfill activity." Additionally, as noted in the jurisdiction determination report (see Appendix I/IIE), no wetlands exist within the two proposed disposal areas.

12 PROTECTION OF ENDANGERED OR THREATENED SPECIES (30 TAC §330.61(n))

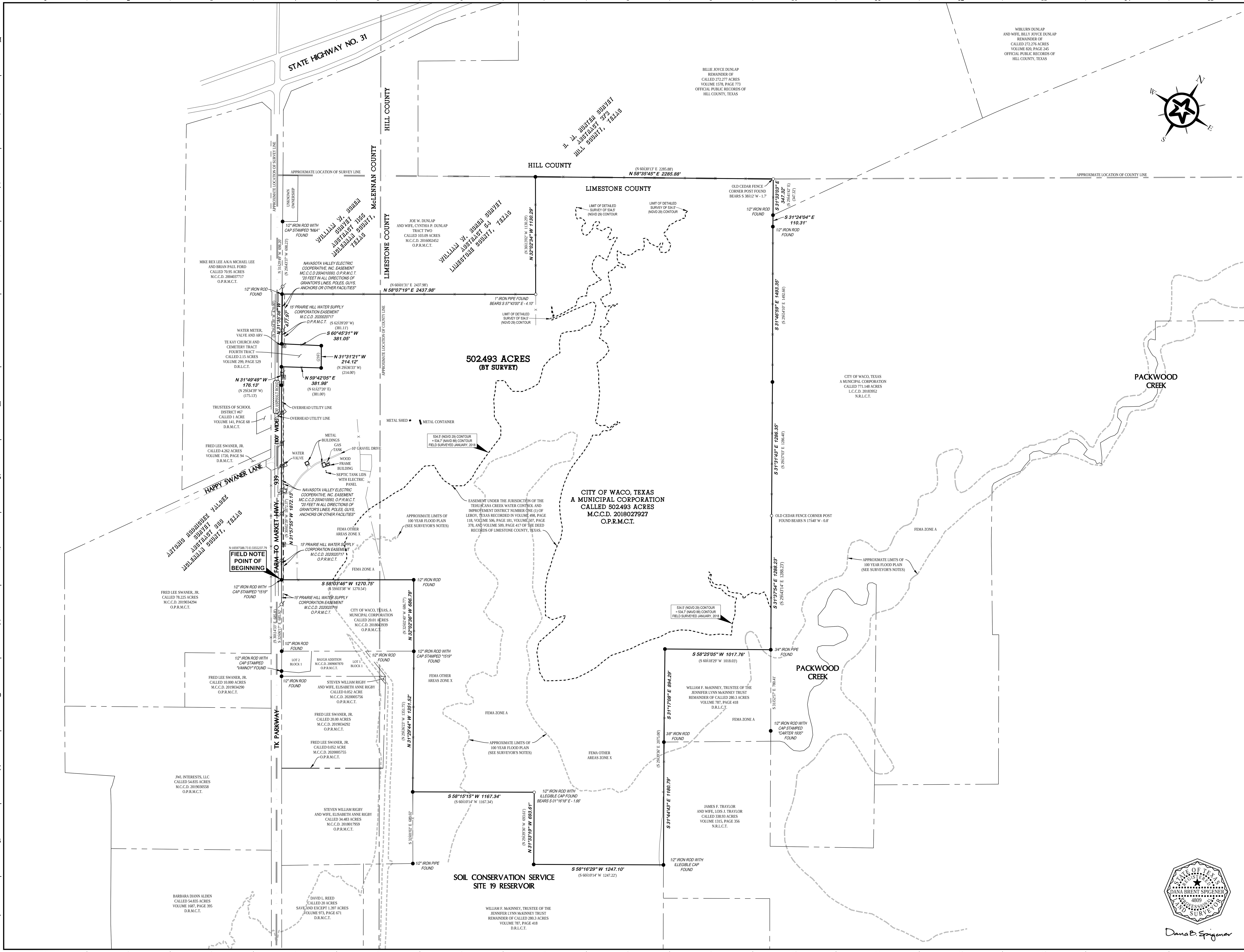
See coordination letters to the US Fish and the Texas Parks and Wildlife Department (with attachments) from C. Lee Sherrod of Horizon Environmental Services in Appendix I/IIA. These letters address the TCEQ regulations listed above, noting, "The site is not in an area designated as critical habitat for any listed threatened or endangered species, nor does the site provide suitable habitat for any federally-listed species." Based on the response from Texas Parks and Wildlife Department (see Appendix I/IIA), the "Wildlife Habitat Assessment Program does not anticipate significant adverse impacts to rare, threatened, or endangered species, or other fish and wildlife resources."

In addition, a Biological Assessment Report performed by Horizon Environmental Services, Inc., dated February, 2020 is included in Appendix I/IIG. This report includes a Management Plan for endangered or threatened species.

In view of the above, consistent with 30 TAC §330.61(n), it is concluded that the development and operation of this landfill will not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, or cause or contribute to the taking of threatened or endangered species or result in adverse impact to critical habitat of threatened or endangered species.

ATTACHMENT 14A

METES AND BOUNDS SURVEY
AND LEGAL DESCRIPTION



LEGEND

D.R.M.C.T.	= DEED RECORDS McLENNAN COUNTY, TEXAS
M.C.C.D.	= McLENNAN COUNTY CLERK'S DOCUMENT
O.P.R.M.C.T.	= OFFICIAL PUBLIC RECORDS McLENNAN COUNTY, TEXAS
D.R.L.C.T.	= DEED RECORDS LIMESTONE COUNTY, TEXAS
N.R.L.C.T.	= NAMED RECORDS LIMESTONE COUNTY, TEXAS
O.P.R.H.C.T.	= OFFICIAL PUBLIC RECORDS HILL COUNTY, TEXAS
( )	= DEED CALLS
○	= 1/2" IRON ROD WITH CAP STAMPED "WALKER PARTNERS" SET
●	= 1/2" IRON ROD WITH CAP STAMPED "4748" FOUND UNLESS LABELED OTHERWISE
—X—	= BARBED WIRE FENCE
⋈	= WATER VALVE
W	= WATER METER
—○—	= UTILITY POLE
←—	= GUY WIRE
—E—	= OVERHEAD ELECTRIC LINE

SURVEYOR'S NOTES

SURVEY DATE: JANUARY & FEBRUARY, 2018

RELEASE DATE: JULY 18, 2018

FIELD NOTES ATTACHED HERETO, MADE A PART HEREOF AND TITLED:
502.493 ACRES LOCATED IN THE WILLIAM W. BOREN SURVEY, ABSTRACT 1155 IN McLENNAN COUNTY, TEXAS AND THE WILLIAM W. BOREN SURVEY, ABSTRACT 54 IN LIMESTONE COUNTY, TEXAS

THE SURVEYOR DID NOT ABSTRACT THE SUBJECT TRACT. THIS SURVEY WAS PERFORMED WITH THE BENEFIT OF A TITLE REPORT PROVIDED BY STEWART TITLE GUARANTY COMPANY, FILE NO. 20173029, WHICH BEARS AN EFFECTIVE DATE OF DECEMBER 14, 2017.
THE EASEMENT INFORMATION SHOWN HEREON IS BASED ON THE EASEMENTS IDENTIFIED IN SCHEDULE "B".

A FLOWAGE EASEMENT EXISTS ON THE SUBJECT PROPERTY THAT IS UNDER THE JURISDICTION OF THE TEHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER ONE (1) OF LEROY, TEXAS RECORDED IN VOLUME 498, PAGE 118, VOLUME 506, PAGE 181, VOLUME 507, PAGE 378, AND VOLUME 509, PAGE 417 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) NOTE:
BY GRAPHIC PLOTTING ONLY THIS PROPERTY IS IN FEMA "SPECIAL FLOOD HAZARD AREAS" ZONE A AND FEMA "OTHER AREAS" ZONE X AS SHOWN ON THE FLOOD INSURANCE RATE MAP, LIMESTONE COUNTY, TEXAS, COMMUNITY PANEL 48293C0125C, WHICH BEARS AN EFFECTIVE DATE OF SEPTEMBER 16, 2011.
BY GRAPHIC PLOTTING ONLY THIS PROPERTY IS IN FEMA "SPECIAL FLOOD HAZARD AREAS" ZONE A AND FEMA "OTHER AREAS" ZONE X AS SHOWN ON THE FLOOD INSURANCE RATE MAP, McLENNAN COUNTY, TEXAS, COMMUNITY PANEL 48309C0250D, WHICH BEARS AN EFFECTIVE DATE OF DECEMBER 20, 2019.

THIS FLOOD STATEMENT DOES NOT IMPLY THAT THIS TRACT WILL, OR WILL NOT FLOOD, NOR DOES IT CREATE ANY LIABILITY IN SUCH EVENT ON THE PART OF THIS SURVEYOR OR COMPANY.

EXPLANATION OF FEMA ZONES:

FEMA "SPECIAL FLOOD HAZARD AREAS" ZONE A = NO BASE FLOOD ELEVATIONS DETERMINED.

FEMA "OTHER AREAS" ZONE X = AREAS DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN.

THE BEARINGS AND GRID COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS STATE PLANE COORDINATE SYSTEM, NAD 83, TEXAS CENTRAL ZONE.

THE SPECIFIC PURPOSE OF THIS UPDATED BOUNDARY SURVEY MAP IS TO IDENTIFY CURRENT OWNERSHIPS, DEED REFERENCES AND EASEMENTS THAT HAVE OCCURRED SINCE THE ORIGINAL RELEASE DATE OF JULY 18, 2018, AND THE TEHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER ONE (1) OF LEROY, TEXAS EASEMENT. THIS UPDATED BOUNDARY SURVEY MAP DOES NOT REPRESENT A CURRENT UPDATE OF THE ON THE GROUND FIELD SURVEY PERFORMED JANUARY & FEBRUARY, 2018.

0 200 400 800

GRAPHIC SCALE (FEET)

REV.	DESCRIPTION	DATE
3	UPDATED EASEMENTS AND OWNERSHIP. ADDED McLENNAN AND HILL COUNTIES TEHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER ONE (1) OF LEROY, TEXAS EASEMENT	09-10-2020
2	REVISED TITLE COMMITMENT NOTE	12-18-2018
1	CHANGED TITLE TO "BOUNDARY SURVEY"	08-06-2018

Walker Partners
engineers ★ surveyors
823 Washington Avenue ● Waco, Texas 76701
Phone: 1-254-714-1402 ● T.B.P.E. Registration No. 8053
T.B.P.L.S. Registration No. 10032500

BOUNDARY SURVEY
502.493 ACRE TRACT

LOCATED IN THE WILLIAM W. BOREN SURVEY, ABSTRACT 1155 IN McLENNAN COUNTY, TEXAS AND THE WILLIAM W. BOREN SURVEY, ABSTRACT 54 IN LIMESTONE COUNTY, TEXAS, AND BEING ALL OF A CALLED 502.493 ACRE TRACT DESCRIBED IN A DEED TO THE CITY OF WACO, TEXAS, A MUNICIPAL CORPORATION RECORDED IN McLENNAN COUNTY CLERK'S DOCUMENT 2018027927 OF THE OFFICIAL PUBLIC RECORDS OF McLENNAN COUNTY, TEXAS

STATE OF TEXAS
DANA BRENT SPIGENER
4809
PROFESSIONAL LAND SURVEYOR

Dana B. Spigener

PLAT NUMBER	D1-0509
PROJECT NUMBER	1-03063
DRAWN BY/CHECKED BY	DBS/KRH
FIELD NOTE NO.	FN-13
DRAWING NAME	1-03063BOUNDARY SURVEY 2020 2.DWG
DRAFT DATE	07/11/2018
SHEET NUMBER	1 OF 1

Walker Partners
engineers ★ surveyors

823 Washington Ave.
Waco, Texas 76701

502.493 ACRES
LOCATED IN THE WILLIAM W. BOREN SURVEY, ABSTRACT 1155 IN McLENNAN COUNTY, TEXAS AND THE WILLIAM W. BOREN SURVEY, ABSTRACT 54 IN LIMESTONE COUNTY, TEXAS

FIELD NOTES FOR A 502.493 ACRE TRACT OF LAND LOCATED IN THE WILLIAM W. BOREN SURVEY, ABSTRACT 1155 IN McLENNAN COUNTY, TEXAS AND THE WILLIAM W. BOREN SURVEY, ABSTRACT 54 IN LIMESTONE COUNTY, TEXAS, AND BEING ALL OF A CALLED 502.493 ACRE TRACT DESCRIBED IN A DEED TO THE CITY OF WACO, TEXAS, A MUNICIPAL CORPORATION RECORDED IN McLENNAN COUNTY CLERK'S DOCUMENT (M.C.C.D.) 2018027927 OF THE OFFICIAL PUBLIC RECORDS OF McLENNAN COUNTY, TEXAS (O.P.R.M.C.T.). SAID 502.493 ACRE TRACT BEING MORE PARTICULARLY SHOWN ON THE ATTACHED BOUNDARY SURVEY DRAWING AND FURTHER DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING AT A 1/2" IRON ROD WITH A CAP STAMPED "1519" FOUND IN THE EAST RIGHT-OF-WAY LINE OF FARM TO MARKET HIGHWAY 939, ALSO KNOWN AS TK PARKWAY (100' WIDE) MARKING THE NORTHWEST CORNER OF A CALLED 20.01 ACRE TRACT DESCRIBED IN A DEED TO THE CITY OF WACO, TEXAS, A MUNICIPAL CORPORATION RECORDED IN M.C.C.D. 2018043939 OF THE O.P.R.M.C.T., SAME BEING AN OUTSIDE ELL CORNER OF SAID 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT, FROM WHICH A 1/2" IRON ROD FOUND IN THE EAST RIGHT-OF-WAY LINE OF SAID FARM TO MARKET HIGHWAY 939 MARKING THE SOUTHWEST CORNER OF SAID 20.01 ACRE TRACT BEARS S 32°06'17" E – 685.92';

THENCE N 31°57'55" W – 1872.13' WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID FARM TO MARKET HIGHWAY 939 TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND MARKING AN ANGLE POINT OF THE WEST LINE OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT;

THENCE N 31°49'49" W – 176.13' WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID FARM TO MARKET HIGHWAY 939 TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND MARKING THE SOUTHWEST CORNER OF THE TE KAY CHURCH AND CEMETERY TRACT (NO DEED FOUND OF RECORD BY THIS SURVEYOR) FOR AN OUTSIDE ELL CORNER OF THE HEREIN DESCRIBED TRACT;

THENCE WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID TE KAY CHURCH AND CEMETERY TRACT THE FOLLOWING THREE CALLS:

1) **N 59°42'05" E – 381.98'** TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND MARKING THE SOUTHEAST CORNER OF THE TE KAY CHURCH AND CEMETERY TRACT FOR AN INSIDE ELL CORNER OF THE HEREIN DESCRIBED TRACT,
2) **N 31°31'21" W – 214.12'** TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND MARKING THE NORTHEAST CORNER OF THE TE KAY CHURCH AND CEMETERY TRACT FOR AN INSIDE ELL CORNER OF THE HEREIN DESCRIBED TRACT,
3) **S 60°45'31" W – 381.05'** TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND IN THE EAST RIGHT-OF-WAY LINE OF SAID FARM TO MARKET HIGHWAY 939 MARKING THE NORTHWEST CORNER OF THE TE KAY CHURCH AND CEMETERY TRACT FOR AN OUTSIDE ELL CORNER OF THE HEREIN DESCRIBED TRACT;

THENCE N 31°35'38" W – 477.97' WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID FARM TO MARKET HIGHWAY 939 TO A 1/2" IRON ROD FOUND MARKING THE SOUTHWEST CORNER OF A CALLED 103.09 ACRE TRACT DESCRIBED AS TRACT TWO IN A DEED TO JOE W. DUNLAP AND WIFE, CYNTHIA P. DUNLAP RECORDED IN M.C.C.D. 2016002452 OF THE O.P.R.M.C.T., FROM WHICH A 1/2" IRON ROD WITH A CAP STAMPED "M&A" FOUND IN THE EAST RIGHT-OF-WAY LINE OF FARM TO MARKET HIGHWAY 939 MARKING AN OUTSIDE ELL CORNER OF SAID 103.09 ACRE TRACT BEARS N 31°29'49" W – 698.20';

THENCE WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID 103.09 ACRE TRACT THE FOLLOWING TWO CALLS:

1) **N 58°07’19” E – 2437.98’** TO A 1/2” IRON ROD WITH A CAP STAMPED “WALKER PARTNERS” SET FOR THE SOUTHEAST CORNER OF THE 103.09 ACRE TRACT AND AN INSIDE ELL CORNER OF THE HEREIN DESCRIBED TRACT, FROM WHICH A 1” IRON PIPE FOUND BEARS S 57°43’00” E – 4.10’,
2) **N 32°02’34” W – 1130.29’** TO A 1/2” IRON ROD WITH A CAP STAMPED “4748” FOUND IN THE SOUTH LINE OF THE REMAINDER OF A CALLED 272.277 ACRE TRACT DESCRIBED IN A DEED TO BILLIE JOYCE DUNLAP RECORDED IN VOLUME 1578, PAGE 773 OF THE OFFICIAL PUBLIC RECORDS OF HILL COUNTY, TEXAS MARKING AN OUTSIDE ELL CORNER OF THE 103.09 ACRE TRACT AND AN OUTSIDE ELL CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT;

THENCE N 58°35’45” E – 2285.88’ WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND THE REMAINDER OF SAID 272.277 ACRE TRACT TO A 1/2” IRON ROD WITH A CAP STAMPED “WALKER PARTNERS” SET MARKING AN INSIDE ELL CORNER OF THE 272.277 ACRE TRACT, SAME BEING THE NORTHEAST CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT;

THENCE S 31°33’03” E – 347.32’ TO A 1/2” IRON ROD FOUND MARKING A SOUTH CORNER OF THE REMAINDER OF THE 272.277 ACRE TRACT, SAME BEING THE MOST WESTERLY NORTHWEST CORNER OF A CALLED 771.148 ACRE TRACT DESCRIBED IN A DEED TO THE CITY OF WACO, TEXAS, A MUNICIPAL CORPORATION RECORDED IN LIMESTONE COUNTY CLERK’S DOCUMENT 20183952 OF THE NAMED RECORDS OF LIMESTONE COUNTY, TEXAS;

THENCE WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID 711.148 ACRE TRACT THE FOLLOWING FOUR CALLS:

1) **S 31°24’04” E – 110.31’** TO A 1/2” IRON ROD FOUND FOR AN ANGLE POINT,
2) **S 31°46’59” E – 1493.35’** TO A 1/2” IRON ROD WITH A CAP STAMPED “4748” FOUND FOR AN ANGLE POINT,
3) **S 31°31’43” E – 1286.35’** TO A 1/2” IRON ROD WITH A CAP STAMPED “WALKER PARTNERS” SET FOR AN ANGLE POINT,
4) **S 31°37’54” E – 1288.23’** TO A 3/4” IRON PIPE FOUND MARKING A NORTHEAST CORNER OF A REMAINDER OF A CALLED 280.3 ACRE TRACT DESCRIBED IN A DEED TO WILLIAM F. McKINNEY, TRUSTEE OF THE JENNIFER LYNN McKINNEY TRUST RECORDED IN VOLUME 787, PAGE 418 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS (D.R.L.C.T.), SAME BEING AN OUTSIDE ELL CORNER OF SAID 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT, FROM WHICH A 1/2” IRON ROD WITH A CAP STAMPED “CARTER 1935” FOUND FOR REFERENCE IN THE COMMON LINE OF SAID 771.148 ACRE TRACT AND THE REMAINDER OF SAID 280.3 ACRE TRACT BEARS S 31°52’57” E – 780.41’;

THENCE S 58°25’05” W – 1017.76’ TO A 1/2” IRON ROD WITH A CAP STAMPED “4748” FOUND MARKING A NORTHWEST CORNER OF THE REMAINDER OF SAID 280.3 ACRE TRACT, SAME BEING AN INSIDE ELL CORNER OF SAID 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT;

THENCE S 31°17’08” E – 894.29’ TO A 3/8” IRON ROD FOUND MARKING A SOUTHWEST CORNER OF THE REMAINDER OF SAID 280.3 ACRE TRACT, SAME BEING THE NORTHWEST CORNER OF A CALLED 338.93 ACRE TRACT DESCRIBED IN A DEED TO JAMES F. TRAYLOR AND WIFE, LOIS J. TRAYLOR RECORDED IN VOLUME 1315, PAGE 356 OF THE NAMED RECORDS OF LIMESTONE COUNTY, TEXAS;

THENCE S 31°44’43” E – 1180.79’ WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID 338.93 ACRE TRACT TO A 1/2” IRON ROD WITH AN ILLEGIBLE CAP FOUND MARKING THE SOUTHEAST CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT AT A NORTHEAST CORNER OF ANOTHER REMAINDER OF SAID 280.3 ACRE TRACT;

THENCE WITH THE COMMON LINE OF SAID 502.493 ACRE TRACT AND SAID 280.3 ACRE TRACT THE FOLLOWING THREE CALLS:

1) **S 58°16'29" W – 1247.10'** TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND MARKING AN OUTSIDE ELL CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT,
2) **N 31°33'19" W – 693.61'** TO A 1/2" IRON ROD WITH A CAP STAMPED "WALKER PARTNERS" SET FOR AN INSIDE ELL CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT, FROM WHICH A 1/2" IRON ROD WITH AN ILLEGIBLE CAP FOUND BEARS S 01°16'18" E – 1.66',
3) **S 58°15'15" W – 1167.34'** TO A 1/2" IRON ROD WITH A CAP STAMPED "4748" FOUND IN THE EAST LINE OF A CALLED 34.483 ACRE TRACT DESCRIBED IN A DEED TO STEVEN WILLIAM RIGBY AND WIFE, ELISABETH ANNE RIGBY RECORDED IN M.C.C.D. 2018017959 OF THE O.P.R.M.C.T. AT AN OUTSIDE ELL CORNER OF THE REMAINDER OF THE 280.3 ACRE TRACT MARKING A SOUTHWEST CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT, FROM WHICH A 1/2" IRON ROD FOUND MARKING THE SOUTHEAST CORNER OF SAID 34.483 ACRE TRACT AT AN INSIDE ELL CORNER OF THE REMAINDER OF THE 280.3 ACRE TRACT BEARS S 32°01'02" E – 689.02';

THENCE N 31°29'44" W – 1351.52' TO A 1/2" IRON ROD WITH A CAP STAMPED "1519" FOUND MARKING THE NORTHEAST CORNER OF SAID 34.483 ACRE TRACT, SAME BEING THE SOUTHEAST CORNER OF SAID 20.01 ACRE TRACT;

THENCE N 32°02'36" W – 686.78' TO A 1/2" IRON ROD FOUND MARKING THE NORTHEAST CORNER OF SAID 20.01 ACRE TRACT AT AN INSIDE ELL CORNER OF THE 502.493 ACRE TRACT AND OF THE HEREIN DESCRIBED TRACT;

THENCE S 58°03'46" W – 1270.75' WITH THE COMMON LINE OF THE SAID 502.493 ACRE TRACT AND SAID 20.01 ACRE TRACT RETURNING TO THE **POINT OF BEGINNING** AND CONTAINING 502.493 ACRES OF LAND. AS SURVEYED BY DANA B. SPIGENER, REGISTERED PROFESSIONAL LAND SURVEYOR, NO. 4809, IN JANUARY AND FEBRUARY, 2018. BEARINGS CITED WITHIN THIS DESCRIPTION ARE BASED ON TEXAS STATE PLANE COORDINATE SYSTEM, NAD 83, TEXAS CENTRAL ZONE ACQUIRED FROM GLOBAL POSITIONING SYSTEM OBSERVATIONS.

THE SPECIFIC PURPOSE OF THIS REVISED FIELD NOTE DESCRIPTION OF AUGUST 19, 2020 IS TO IDENTIFY CURRENT OWNERSHIPS AND DEED REFERENCES THAT HAVE OCCURRED SINCE THE ORIGINAL RELEASE DATE OF APRIL 6, 2018. THIS REVISED FIELD NOTE DESCRIPTION DOES NOT REPRESENT A CURRENT UPDATE OF THE ON THE GROUND FIELD SURVEY PERFORMED JANUARY AND FEBRUARY, 2018.

SURVEYED: JANUARY & FEBRUARY, 2018
RELEASED: APRIL 16, 2018
REVISED: JULY 2, 2018
REVISED: AUGUST 19, 2020

Dana B. Spigener
DANA B. SPIGENER, R.P.L.S. 4809

PROJ NO. 1-03063.01
PLAT NO. D1-0509
FIELD NOTE NO. 13
MAP CHECKED 04/13/2018 DBS

16 EVIDENCE OF COMPETENCY (30 TAC §330.59(f))

16.1 CITY OF WACO

The applicant, the City of Waco, currently owns and operates a Type 1 MSW Landfill, TCEQ Permit No. MSW-948A (Site 948A). The existing landfill (Site 948A) was initially permitted under MSW Permit No. 948 on July 22, 1977, and subsequently a permit amendment was approved for MSW Permit 948A on September 21, 1987. While Site 948A is the only landfill that the City has operated in the last 10 years, the City previously operated the following MSW landfills, which have been closed in accordance with TCEQ requirements:

- City of Waco Closed Type 1 MSW Landfill, Permit No. 1419 issued on September 3 1981, located on FM 3400 southeast of Waco; stopped accepting waste on June 17, 1986.
- City of Waco Closed Type 1 MSW Landfill, Permit No. 1039 issued on July 22, 1977, located on FM 3400 southeast of Waco; stopped receiving waste on June 24, 1983.

The competency of the City of Waco to operate the proposed landfill is evidenced by the City's operating history, over 20 years of operating Site 948A. The City of Waco has no financial interest in any solid waste facilities in any other states, territories, or countries.

16.2 THE CITY OF WACO KEY PERSONNEL

As with Site 948A, the proposed landfill will be administered within the City's Public Works Department. Key personnel include the following: Director of Public Works, Landfill Manager, and Environmental Programs Manager.

- Charles Dowdell, the Director of Solid Waste Services for the City, has over 45 years of experience in managing and operating landfills, including nine years with the City of Waco. His pertinent experience includes the following:
  - Two years as landfill manager of Site 948A, responsible for managing landfill staff, equipment maintenance, day-to-day operation of the landfill, regulatory compliance, community relations, and related activities.
  - Nine years as either the Director of Solid Waste Services, Director of Public Works or Special Projects. In these positions, he has had the responsibility for the management of the landfill, which includes overseeing the landfill manager, assuring adequate budgets for landfill staff, equipment, and third-party consultants and contractors, and ultimate regulatory compliance for the landfill. Currently, Mr. Dowdell is the Director of Solid Waste Services for the City.
  - Forty years as a consulting engineer, including the design, permitting, construction, monitoring, and operation of landfills. In addition, Mr. Dowdell has a TCEQ MSW Class "A" license, as well as licensed as a Professional Geoscientist.

- David Rydl, Landfill Manager for Site 948A, has over 20 years of experience in managing and operating landfills, including six years with the City of Waco. In the capacity of Landfill Manager for Site 948A, he is responsible for managing landfill staff, equipment maintenance, day-to-day operation and construction of the landfill consistent with TCEQ requirements, community relations, and related activities. In addition to his experience with the City of Waco, he has over 13 years of similar landfill management experience with other municipal governments. In addition, he has a TCEQ MSW Class "A" license as well as the Manager of Landfill Operations (MOLO) license through the Solid Waste Association of North America (SWANA).

- Anna Dunbar, Solid Waste Administrator for the City of Waco, Solid Waste Services Department, has been working with the City for approximately eight years. Her prior experience includes the following:
  - Served as TCEQ Waco Regional Office Regional Director for 10 years.
  - Served as the Waste Program Manager in TCEQ Waco Regional Office for one year.
  - Served as an environmental scientist with Nalco Chemical Company over the stormwater, wastewater, and RCRA programs for two years.
  - Served as an Enforcement Coordinator and Assistant Section Chief of Enforcement at the Texas Water Commission in Austin for four years

The City of Waco will ensure that a landfill manager is employed, and serves as the Solid Waste Facility Supervisor as defined in 30 TAC 30.207(2). The landfill manager will have the requisite managerial and technical qualifications to assure that the City's proposed MSW facilities comply with TCEQ requirements and is trained in the practical aspects of the design, operation, maintenance and supervision of a solid waste facility according to standards, rules or orders established by the TCEQ. These qualifications include the following:

- **Education and/or Experience** – A minimum of five years related experience and/or training, or equivalent combination of education and experience, including a MSW Facility Class A License as a municipal solid waste facility supervisor.
- **Language Skills** – Ability to read and interpret documents such as safety rules, operating and maintenance instructions, and procedure manuals. Ability to write routine reports and correspondence.
- **Mathematical Skills** - Ability to calculate figures and amounts such as area, volume, disposal fees (per TCEQ rules), discounts, interest, and percentages.
- **Problem Solving Skills -** Ability to solve practical problems and deal with a variety of situations where only limited standardization exists.

Additionally, other landfill personnel will include customer services representatives (including gate attendants), maintenance workers (load inspectors/spotters), equipment operators, and temporary laborers, as described in Part IV – Site Operating Plan, Section 2.

16.3 EQUIPMENT TO BE DEDICATED TO THIS LANDFILL

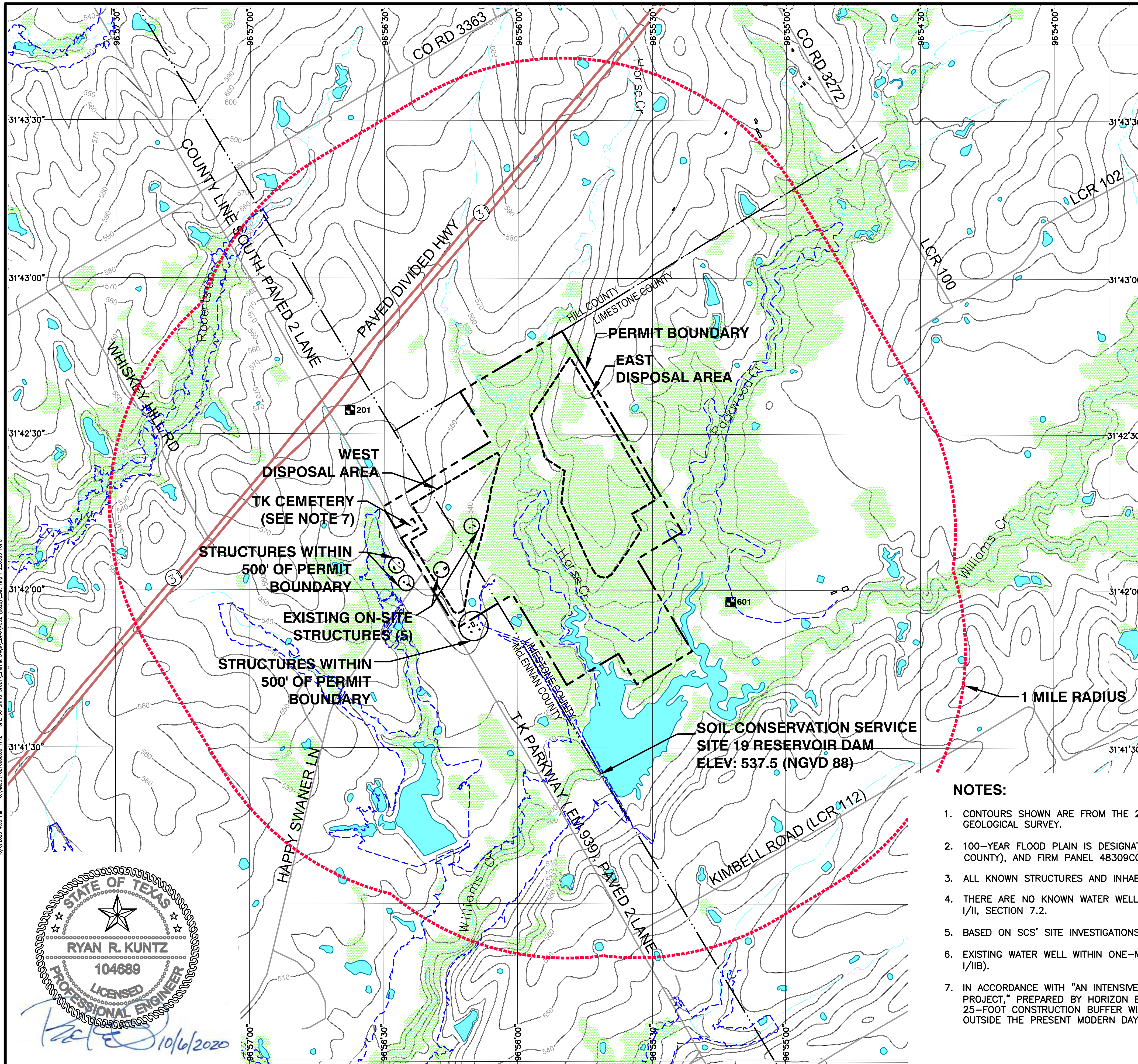
Sufficient equipment will be provided to conduct site operations in accordance with the landfill design and permit conditions. As this landfill is intended to replace the Site 948A, which has a remaining operating life of less than six years, it is assumed that the equipment needs at that time will be similar to those of Site 948A and will include the following minimum number and types of equipment:

- 2 – Landfill Compactors (Caterpillar 826 or equivalent)
- 2 - Bulldozers (Caterpillar D8 or equivalent)
- 1 - Excavators
- 2 - Off-road dump trucks
- 1 - Motor grader
- 1 - Water truck (minimum 2,000 gallon capacity)

The equipment requirements for this landfill will be based on anticipated solid waste volume and field conditions consistent with 30 TAC §330.127. The Director of Public Works, with input from the Landfill Manager or his designee, will routinely assess the equipment needed to maintain compliance with the TCEQ regulations and make adjustments, as appropriate.

DRAWINGS

- Drawing I/II-1: Site Location Map
- Drawing I/II-2: General Topographic Map (includes Wind Rose)
- Drawing I/II-3: Landowner's Map
- Drawing I/II-4: Aerial Photograph (9 inch X 9 inch)
- Drawing I/II-5: Facility Layout Map
- Drawing I/II-6: Regional Tectonic/Geology Map
- Drawing I/II-7: Seismic Impact Map



0 1000 2000
SCALE IN FEET

HILL, LIMESTONE, AND MCLENNAN COUNTY

COUNTY LOCATION

LEGEND

- PERMIT BOUNDARY
- 1 MILE RADIUS
- LIMITS OF WASTE
- COUNTY LINE
- 560 EXISTING CONTOURS (SEE NOTE 1)
- FLOOD PLAIN (SEE NOTE 2)
- 96°55'30" LATITUDE/LONGITUDE LINES
- 201 EXISTING WATER WELL (SEE NOTE 6)

ROAD CLASSIFICATION

Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

WIND ROSE

CALM 2.81%
WIND ROSE REPRESENTS AVERAGE PERCENT OF TIME WIND BLOWS FROM EACH OF THE 16 COMPASS POINTS SHOWN.

SOURCE:
TNRCC–EPA
STATION TX03927
AVERAGE VALUES
PERIOD ANALYZED: 1984–1992

NOTES:

1. CONTOURS SHOWN ARE FROM THE 24K QUAD MAP FOR AXTELL, TEXAS (2016) PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY.
2. 100–YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11 (LIMESTONE COUNTY), AND FIRM PANEL 48309C0250D, DATED 12/20/19 (MCLENNAN COUNTY).
3. ALL KNOWN STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET OF PERMIT BOUNDARY ARE SHOWN.
4. THERE ARE NO KNOWN WATER WELLS WITHIN 500 FT. OF THE PROPOSED PERMIT BOUNDARY IN ACCORDANCE WITH PARTS I/II, SECTION 7.2.
5. BASED ON SCS' SITE INVESTIGATIONS, NO SPRINGS WERE OBSERVED ON THE SITE.
6. EXISTING WATER WELL WITHIN ONE–MILE OF PERMIT BOUNDARY (SEE ATLAS ENVIRONMENTAL RESEARCH REPORT, APPENDIX I/IIB).
7. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25–FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.

FOR PERMITTING PURPOSES ONLY

STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED PROFESSIONAL ENGINEER
10/6/2020

REV	DATE	DESCRIPTION	BY
1	12/2018	REVISION FOR PART I/II NOD 1	RRK
2	10/2020	REVISED NOTE 2 AND WDA/EDA LIMIT OF WASTE BOUNDARIES	RRK

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE
GENERAL TOPOGRAPHIC MAP

PROJECT TITLE
CITY OF WACO LANDFILL
TYPE I MSW - PERMIT APPLICATION

CLIENT
CITY OF WACO
501 SHROEDER
WACO, TEXAS 76710

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

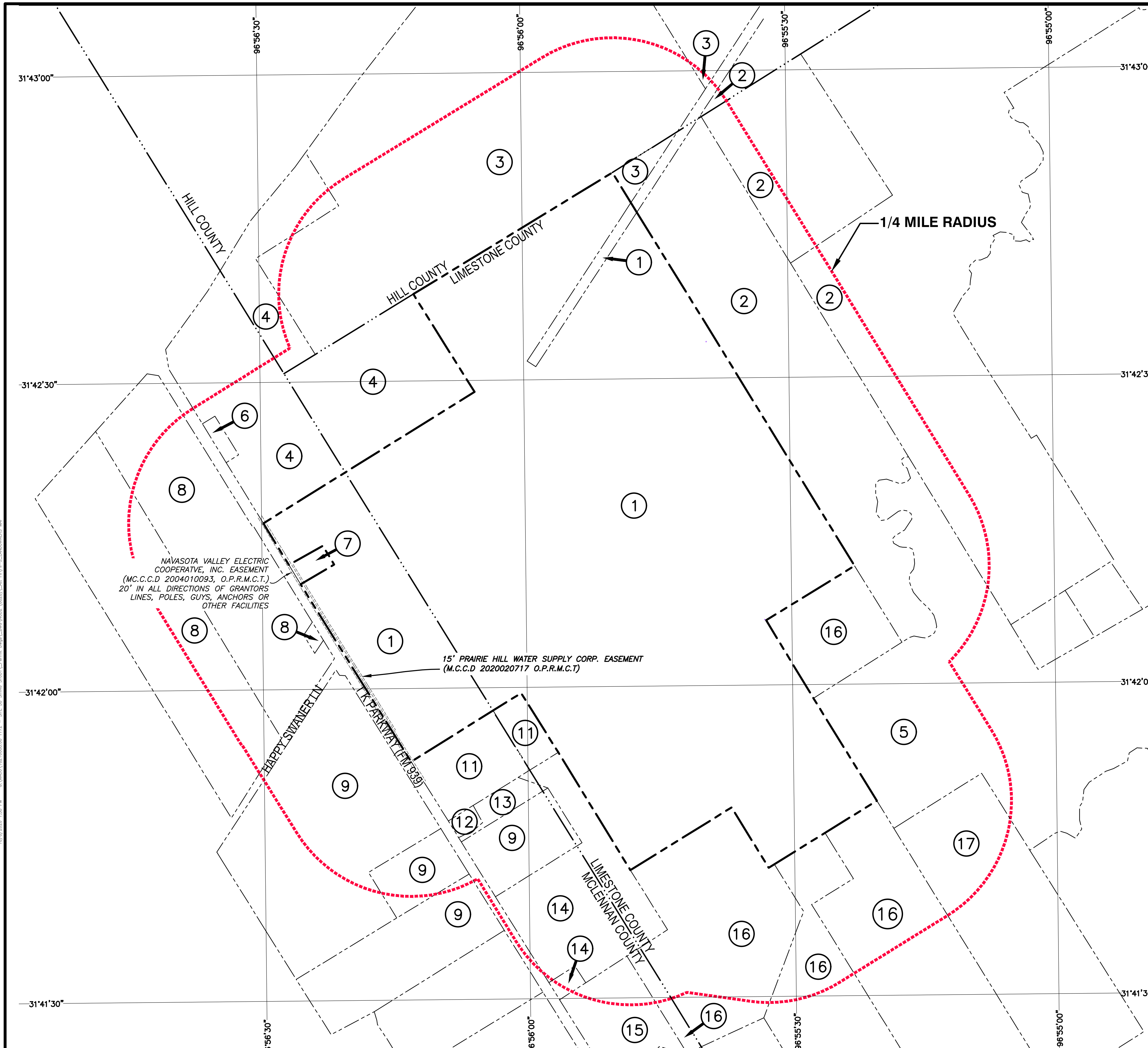
PROJ. NO. 16216088.00 | DSN. BY: RRK | DWN. BY: BJJ | CHK. BY: KDY | Q/A RVW BY: KDY | APP. BY: RRK

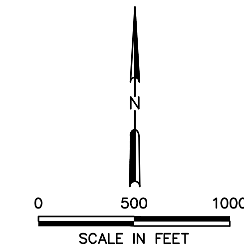
CADD FILE: I/II-2_USGS TOPO

DATE: 08/2018

SCALE: AS SHOWN

DRAWING NO.
I/II-2





LEGEND

- PERMIT BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- COUNTY LINE
- 1/4 MILE RADIUS
- 96°55'30" LATITUDE/LONGITUDE LINES

NOTES:

1. (X) CORRESPONDS TO LANDOWNERS LISTED ON LANDOWNERS LIST.
2. PROPERTY OWNERS WITHIN 1/4 MILE OF THE PERMIT BOUNDARY ARE SHOWN.
3. LANDOWNER PROPERTY BOUNDARIES INDICATED ARE APPROXIMATE.
4. A FLOWAGE EASEMENT EXISTS ON THE PROPERTY THAT IS UNDER THE JURISDICTION OF THE TECHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER (1) OF LEROY, TEXAS SUBJECT TO THE EASEMENT RECORDED IN VOLUME 498, PAGE 118, VOLUME 506, PAGE 181, VOLUME 507, PAGE 378, AND VOLUME 509, PAGE 417 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS.

STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED
PROFESSIONAL ENGINEER
10/6/2020

FOR PERMITTING PURPOSES ONLY

REV	DATE	DESCRIPTION	BY
1	10/2020	UPDATED LANDOWNER LABELS AND PROPERTY BOUNDARIES, REMOVED FIBER OPTIC EASEMENT AND NOTE, UPDATED WATER LINE EASEMENT CALLOUT, CHANGES TO LAYOUT, AND RENUMBERED NOTES	RRK

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE
LANDOWNER'S MAP

PROJECT TITLE
CITY OF WACO LANDFILL TYPE I MSW - PERMIT APPLICATION

CLIENT
CITY OF WACO
501 SHROEDER
WACO, TEXAS 76710

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

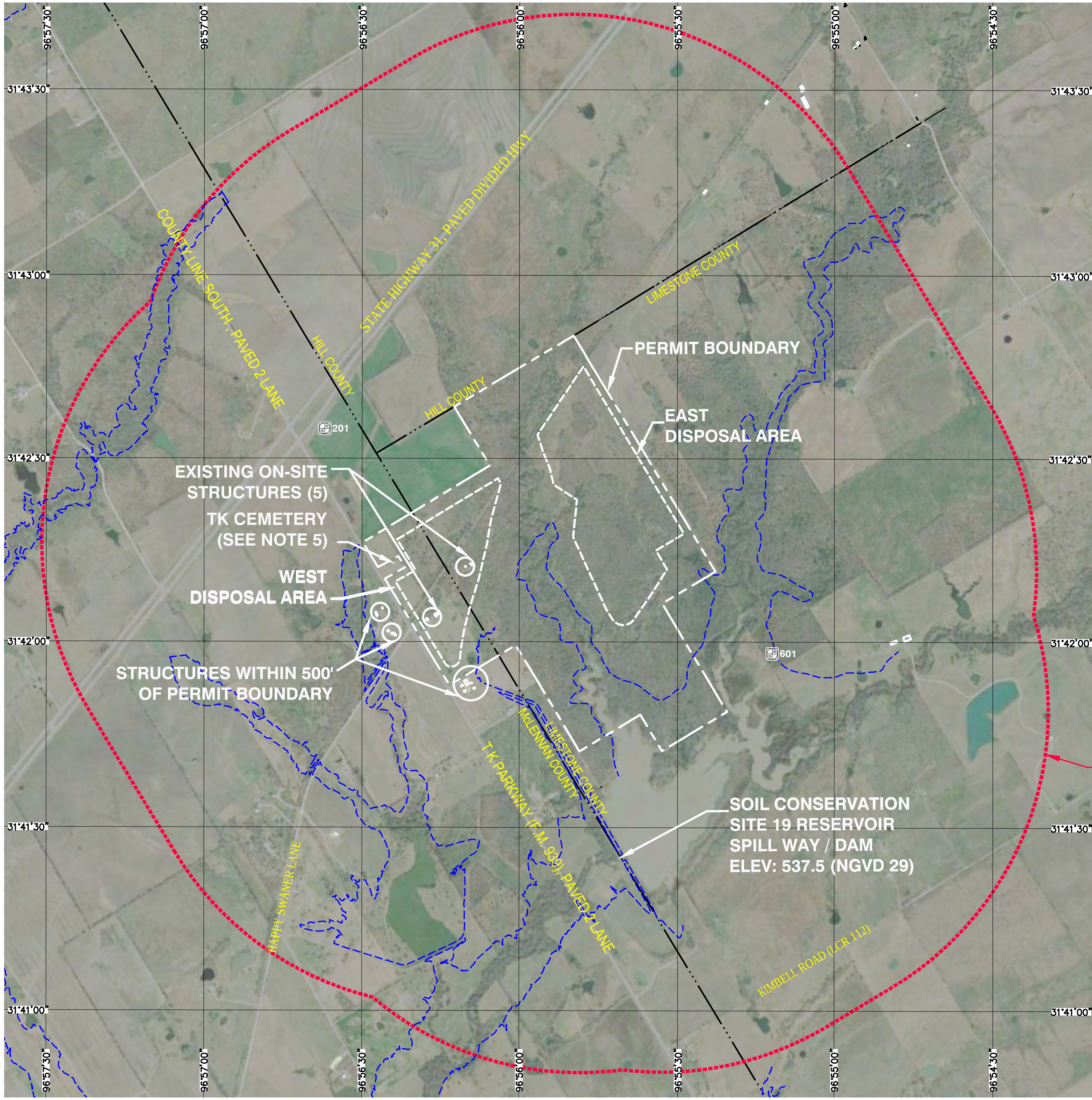
PROJ. NO. 16216088.00 | DWN. BY: JLJ | Q/A RVW BY: KDY
DSN. BY: RRK | CHK. BY: KDY | APP. BY: RRK

CADD FILE: I/II-3_LANDOWNERS MAP

DATE: 08/2018

SCALE: AS SHOWN

DRAWING NO.
I/II-3



N

0 1000 2000
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMITS OF WASTE
- COUNTY LINE
- 1 MILE RADIUS
- FLOOD PLAIN (SEE NOTE 2)
- 96°55'30" LATITUDE/LONGITUDE LINES

NOTES:

1. AERIAL SHOWN WAS SOURCED FROM GOOGLE EARTH, IMAGERY DATED 09/07/17.
2. 100–YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11 (LIMESTONE COUNTY), AND FIRM PANEL 48309C0250D, DATED 12/20/19 (MCLENNAN COUNTY).
3. ALL KNOWN STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET OF PERMIT BOUNDARY ARE SHOWN.
4. EXISTING WATER WELL WITHIN ONE–MILE OF PERMIT BOUNDARY (SEE ATLAS ENVIRONMENTAL RESEARCH REPORT, APPENDIX I/IIB).
5. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25–FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.

STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED
PROFESSIONAL ENGINEER
10/6/2020

FOR PERMITTING PURPOSES ONLY

REV	DATE	DESCRIPTION	BY
1	12/2018	REVISIONS FOR PART I/II NOD1	RRK
2	10/2020	REVISED FLOOD PLAIN AND NOTE 2	RRK

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE: AERIAL PHOTOGRAPH

PROJECT TITLE: CITY OF WACO LANDFILL TYPE I MSW - PERMIT APPLICATION

CLIENT: CITY OF WACO 501 SHROEDER WACO, TEXAS 76710

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

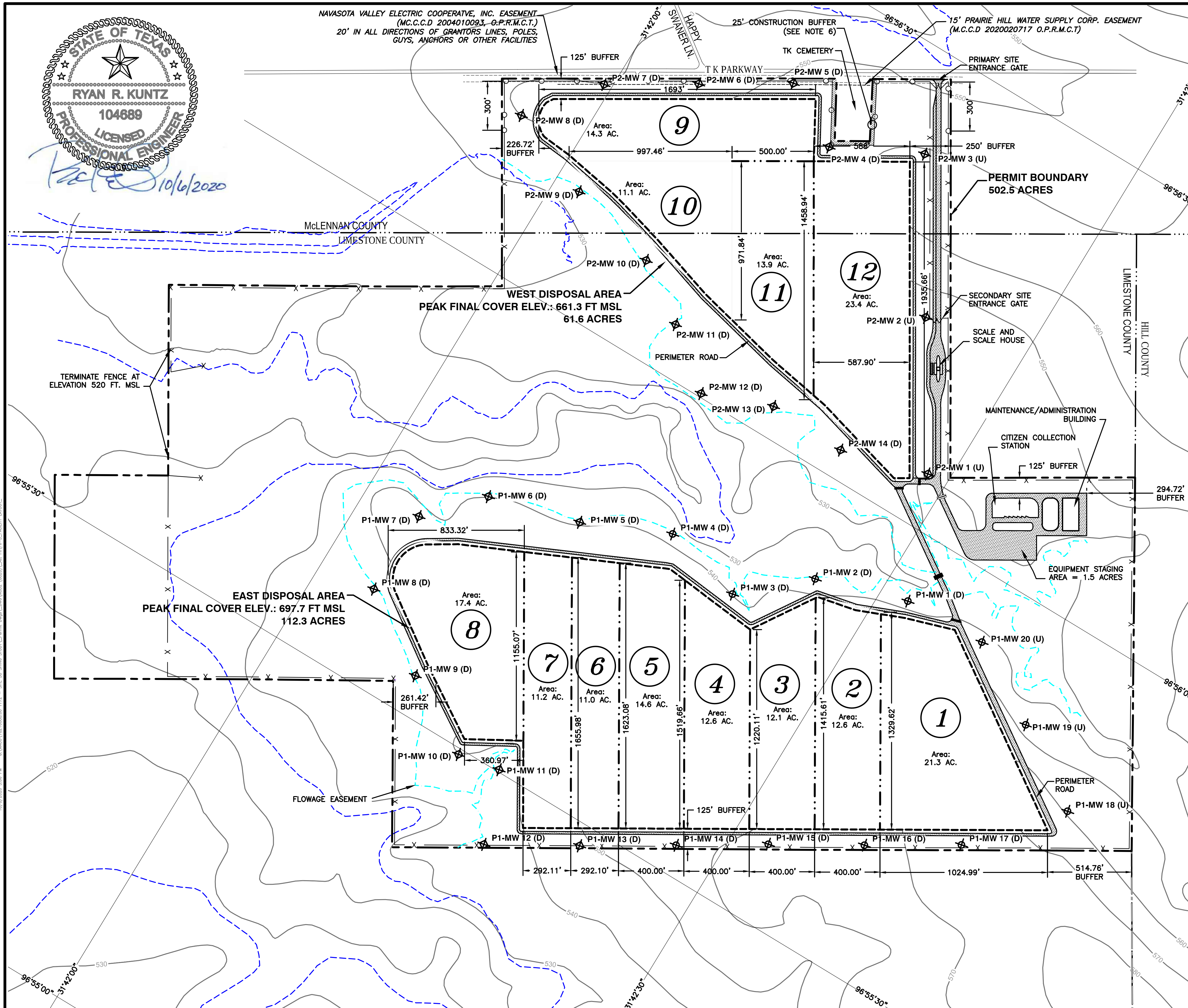
PROJ. NO. 16216088.00 | DSN. BY: RRK | DWN. BY: JLJ | CHK. BY: KDY | Q/A RVW BY: KDY | APP. BY: RRK

CADD FILE: I/II-4_AERIAL MAP

DATE: 08/2018

SCALE: AS SHOWN

DRAWING NO. I/II-4



LEGEND

0 300 600
SCALE IN FEET

- 560 — EXISTING TOPOGRAPHIC CONTOURS (SEE NOTE 1)
- PERMIT BOUNDARY
- LIMITS OF WASTE
- SECTOR BOUNDARY
- COUNTY LINE
- 100–YEAR FLOOD PLAIN (SEE NOTE 2)
- FLOWAGE EASEMENT, ELEVATION 534.5 (NGVD 29) (SEE NOTE 3)
- 96°55'30" — LATITUDE/LONGITUDE LINES
- PERIMETER FENCE
- 8' PRIVACY FENCE
- ACCESS ROAD
- P1-MW 20 (U) — GMW INSTALLED PRIOR TO LANDFILL OPERATION (SEE NOTE 5)
- P2-MW 1 (U) — GMW INSTALLED WHEN WASTE < 1,000 FEET (SEE NOTE 5)
- X — SECTOR DESIGNATION (SEE NOTE 4)

NOTES:

1. CONTOURS SHOWN ARE FROM THE 24K QUAD MAP FOR AXTELL, TEXAS (2016) PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY.
2. 100–YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11 (LIMESTONE COUNTY), AND FIRM PANEL 48309C0250D, DATED 12/20/19 (MCLENNAN COUNTY).
3. A FLOWAGE EASEMENT EXISTS ON THE PROPERTY THAT IS UNDER THE JURISDICTION OF THE TECHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER (1) OF LEROY, TEXAS SUBJECT TO THE EASEMENT RECORDED IN VOLUME 498, PAGE 118, VOLUME 506, PAGE 181, VOLUME 507, PAGE 378, AND VOLUME 509, PAGE 417 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS.
4. SECTOR DEVELOPMENT SEQUENCE REPRESENTED BY SECTOR NUMBER, MAY BE DEVELOPED IN SMALLER INCREMENTS (AKA SUBSECTORS OR CELLS) WITH LINER CERTIFICATIONS SUBMITTED SEPARATELY TO TCEQ.
5. GROUNDWATER MONITORING WELL LOCATIONS ARE BASED ON THE RESULTS OF THE SITE HYDROGEOLOGIC CHARACTERIZATION INCLUDED IN PART III ATTACHMENT 4 OF THE PERMIT APPLICATION, CONSISTENT WITH 30 TAC §330.61(D)(3) AND §330.403.
6. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25–FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.

FOR PERMITTING PURPOSES ONLY

REV	DATE	DESCRIPTION	BY
1	12/2018	REVISIONS	RRK
2	10/2020	REVISION TO NOTE 2, WDA/EDA LIMITS OF WASTE, REMOVAL OF FIBER OPTIC EASEMENT, AND NOTE 3 REVISIONS TO SITE LAYOUT (PERIMETER ROAD, ENTRANCE), AND GMW SYSTEM, AND RENUMBERED NOTES.	RRK

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE: FACILITY LAYOUT PLAN

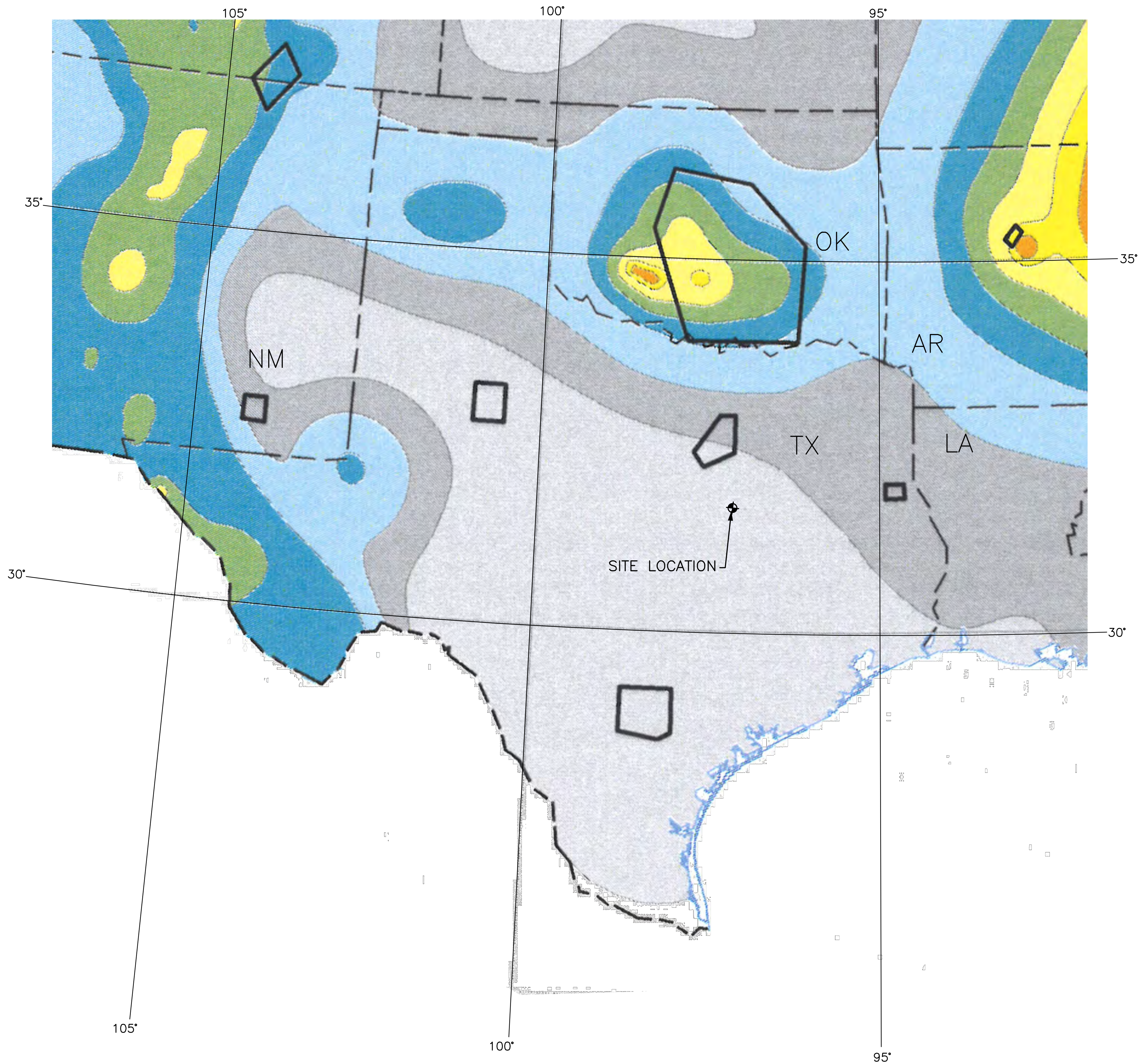
PROJECT TITLE: CITY OF WACO LANDFILL TYPE I MSW - PERMIT APPLICATION

CLIENT: CITY OF WACO
501 SHROEDER
WACO, TEXAS 76710

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

PROJ. NO. 16216088.00 | DSN. BY: RRK | DWN. BY: JLJ | CHK. BY: KDY | APP. BY: RRK | Q/A RVW BY: KDY

CADD FILE: I/II-5_FACILITY LAYOUT
DATE: 08/2018
SCALE: AS SHOWN
DRAWING NO. I/II-5



N

0 50 100
SCALE IN MILES

LEGEND

Areas where suspected nontectonic earthquakes have been detected

EXPLANATION

Peak acceleration, expressed as a fraction of standard gravity (g)

0.8
0.4
0.3
0.2
0.14
0.1
0.06
0.04
0.02
0

SOURCE:
SEISMIC IMPACT ZONE MAP TAKEN FROM THE U.S. GEOLOGICAL SURVEY, UPDATED 2014.

STATE OF TEXAS
James Lawrence
Discipline
License # 541
LICENSED PROFESSIONAL GEOSCIENTIST
James Lawrence
10/6/2020

FOR PERMITTING PURPOSES ONLY

REV	DATE	DESCRIPTION	BY
1	10/2020	REVISED "DELETED" TO "DETECTED".	RRK

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE
SEISMIC IMPACT MAP

PROJECT TITLE
CITY OF WACO LANDFILL
TYPE I MSW - PERMIT APPLICATION

CLIENT
CITY OF WACO
PUBLIC WORKS DEPARTMENT
401 FRANKLIN AVENUE
WACO, TX 76701

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

PROJ. NO.: 16216088.00
DSN. BY: JL
DWN. BY: JLJ
CHK. BY: TM
Q/A RVW BY: TM
APP. BY: JL

CADD FILE: I/II-7_SEISMIC MAP

DATE: 04/2020

SCALE: AS SHOWN

FIGURE: I/II-7

APPENDIX I/IIA

DEMONSTRATION OF COORDINATION (30 TAC 330.61)

- Coordination with Texas Parks and Wildlife Department
- Coordination with U.S. Department of the Interior, Fish and Wildlife Service
- Coordination with Texas Historic Commission
- Coordination with U.S. Army Corp of Engineers
- Coordination with Texas Department of Transportation
- Coordination with Heart of Texas Council of Governments
- Coordination with Federal Aviation Administration

COORDINATION WITH TEXAS PARKS AND WILDLIFE DEPARTMENT

<u>Note:</u> See Appendix I/IIG for the final "Biological Assessment" dated February 2020, prepared by Horizon Environmental Services, Inc., as referenced in the attached coordination correspondence. This assessment also includes a Management Plan for threatened and endangered species.

Lee Sherrod

From: Richard Hanson <Richard.Hanson@tpwd.texas.gov>
Sent: Wednesday, May 6, 2020 7:51 AM
To: Lee Sherrod
Subject: RE: Proposed New Waco Landfill (TPWD# 40806)

[EXTERNAL EMAIL]

Hi Lee,

I will take a look at it and add it to the project file. Thanks.

Rick Hanson
Wildlife Habitat Assessment Program
Texas Parks and Wildlife Department
1702 Landmark Lane, Suite 3
Lubbock, TX 79415
Office: (806) 761-4936
Richard.Hanson@tpwd.texas.gov

From: Lee Sherrod <lee_sherrod@horizon-esi.com>
Sent: Tuesday, May 5, 2020 3:41 PM
To: Richard Hanson <Richard.Hanson@tpwd.texas.gov>
Subject: RE: Proposed New Waco Landfill (TPWD# 40806)

Rick,

Since our earlier communication regarding this project, we have conducted additional species studies, primarily regarding the bald eagle based on antidotal accounts of eagles in the vicinity of the site. The updated Biological Assessment report is attached for your records. Let me know if you have any questions.

Thanks,

C. Lee Sherrod
Certified Professional Wetland Scientist-Emeritus
Direct 512.439.4788 | **Office** 512.328.2430 | **Cell** 512.431.3562
LJA ENVIRONMENTAL SERVICES, LLC.
1507 S INTERSTATE 35
AUSTIN TX 78741-2502
https://ljaenvironmental.com

Lee Sherrod

From: Lee Sherrod
Sent: Tuesday, May 5, 2020 3:41 PM
To: Richard Hanson
Subject: RE: Proposed New Waco Landfill (TPWD# 40806)
Attachments: Biological Assessment Report - Waco 50 - 12 Feb 2020.pdf

Rick,

Since our earlier communication regarding this project, we have conducted additional species studies, primarily regarding the bald eagle based on antidotal accounts of eagles in the vicinity of the site. The updated Biological Assessment report is attached for your records. Let me know if you have any questions.

Thanks,

C. Lee Sherrod
Certified Professional Wetland Scientist-Emeritus
Direct 512.439.4788 | **Office** 512.328.2430 | **Cell** 512.431.3562
LJA ENVIRONMENTAL SERVICES, LLC.
1507 S INTERSTATE 35
AUSTIN TX 78741-2502
https://ljaenvironmental.com

From: Richard Hanson <Richard.Hanson@tpwd.texas.gov>
Sent: Wednesday, October 10, 2018 7:57 AM
To: Lee Sherrod <lee_sherrod@horizon-esi.com>
Subject: Proposed New Waco Landfill (TPWD# 40806)

Hi Lee,

Thank you for submitting the proposed New Waco Landfill located in McLennan and Limestone Counties for review. Based on a review of the documentation and description provided, the Wildlife Habitat Assessment Program does not anticipate significant adverse impacts to rare, threatened, or endangered species, or other fish and wildlife resources. However, please note it is the responsibility of the project proponent to comply with all federal, state, and local laws that protect fish and wildlife. Provided the project plans do not change, TPWD considers coordination to be complete.

Rick Hanson
Wildlife Habitat Assessment Program
Texas Parks and Wildlife Department
1702 Landmark Lane, Suite 3
Lubbock, TX 79415
Office: (806) 761-4936
Richard.Hanson@tpwd.texas.gov

COORDINATION WITH U.S. DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Note: See Appendix I/IIG for the final "Biological Assessment" dated February 2020, prepared by Horizon Environmental Services, Inc., as referenced in the attached coordination correspondence. This assessment also includes a Management Plan for threatened and endangered species.

Horizon™

Environmental Services, Inc.

6 May 2020

US Fish and Wildlife Service
Ecological Services Field Office - Austin
10711 Burnet Road, Suite 200
Austin, Texas 78758-4460

US Fish and Wildlife Service
Ecological Services Field Office – Clear Lake
17629 El Camino Real, Suite 211
Houston, Texas 77058-3051

RE: **Proposed New Waco Landfill:**
McLennan and Limestone Counties, Texas
HJN 150184-003WD
Consultation Code: 02ETAU00-2018-E-02397 and 02ETTX00-2018-E-04079

Dear Sirs:

Since our earlier communication (7 September 2018) with your agency regarding this project, we have conducted additional species studies, primarily regarding the bald eagle based on antidotal accounts of eagles in the vicinity of the site. The updated Biological Assessment report is attached for your records. Let me know if you have any questions.

Sincerely,
For Horizon Environmental Services, Inc.

C. Lee Sherrod

C. Lee Sherrod
Senior Project Manager

CORPORATE HEADQUARTERS
1507 South IH 35 ★ Austin, Texas 78741 ★ 512.328.2430 ★ Fax 512.328.1804 ★ www.horizon-esi.com
An LJA Company

COORDINATION WITH TEXAS HISTORIC COMMISSION

Wednesday, September 11, 2019

Russ Brownlow
Horizon Environmental Services, Inc.
1507 S. IH-35
Austin, TX 78734

Re: Project review under the Antiquities Code of Texas
Final Report: Waco Site 50 Landfill Project
Texas Antiquities Permit # 8566
COMPLETED PERMIT

Dear Colleague:

Thank you for your correspondence describing the above referenced project. This letter presents the comments of the Executive Director of the Texas Historical Commission, the state agency responsible for administering the Antiquities Code of Texas.

The Archeology Division is in receipt of the final report, a completed Abstracts in Texas Contract Archeology form, shape file, curation form, and a tagged PDF copy of the report on CD for the above referenced permit. The submission of the above items demonstrates completion of your permit requirements under Permit #8566

Thank you for your cooperation in this state review process, and for your efforts to preserve the irreplaceable heritage of Texas. If you have any questions concerning our review or if we can be of further assistance, please call Nick Barrett at 512/463-1858 .

Sincerely,

William A. Martin

for
Mark Wolfe
Executive Director

COORDINATION WITH U.S. ARMY CORP OF ENGINEERS

<u>Note:</u> See Appendix I/IIE for the "Section 404 Jurisdictional Determination," dated October 2020, prepared by Horizon Environmental Services, Inc., as referenced in the attached coordination letter.

COORDINATION WITH
TEXAS DEPARTMENT OF TRANSPORTATION

Note: See Appendix I/IID-2 for a Traffic Impact Analysis, dated January 7, 2020, prepared by Lee Engineering, as referenced in the attached TxDOT approval letter, dated March 25, 2020.

Texas Department of Transportation

MEMO

April 24, 2019

To: Matthew Udenenqu, Team Leader
Municipal Solid Waste Permits Section
Waste Permits Division

From: Alanna Bettis, P.E., Section Director
Contracts & MMS Support Section
Maintenance Division

DocuSigned by:
Alanna Bettis
652B54A269034EB...

Subject: Proposed City of Waco Type I Landfill – McLennan & Limestone Counties
Municipal Solid Waste – Permit Application No. 2400
Permit Application (Land Use Determination) – Application Summary for Agency Review
Tracking No. 23201563; RN110471307/CN600131940

After review by TxDOT, it was determined that the City of Waco Landfill falls within 1,000 feet of FM 939. Thus, it is subject to regulations of the Highway Beautification Act and Texas Administrative Code, 43 TAC Chapter 21, Subchapter H. The critical elements for review are as follows:

(1) Before any screening is commenced, the plans and specifications therefor shall first be submitted by the owner of the junkyard to, and approved by, the district engineer of the department who serves the county in which such screening is to be placed.

(2) Such screening shall be located outside the highway right-of-way in such manner as not to interfere in any way with traffic along any highway or roadway.

(3) Such screening may be accomplished by means of earthen berms, plantings, fences, walls, or other durable materials provided they are effective in blocking the view of such junkyard or automobile graveyard from the motoring public traveling in a standard size automobile along the main traveled way of the controlled highway. The height and density of such screening shall be such as to effectively block such view at all times.

(4) Such screening shall be so designed and landscaped as to cause the junkyard or automobile graveyard area to be inconspicuous and pleasing to the motoring public in accordance with the purposes of the Highway Beautification Act.

For further assistance please contact Harsh Doshy at 512-416-3185 or at harsh.doshy@txdot.gov.

Jon Niermann, *Chairman*
Emily Lindley, *Commissioner*
Toby Baker, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

April 5, 2019

Mr. Michael C. Anderson, P.E.
Deputy Director of Maintenance Division
Texas Department of Transportation
125 E. 11th Street
Austin, Texas 78701

Re: Proposed City of Waco Type I Landfill - McLennan and Limestone Counties
Municipal Solid Waste - Permit Application No. 2400
Permit Application (Land Use Determination) - Application Summary for Agency Review
Tracking No. 23201563; RN110471307/CN600131940

Dear Mr. Anderson:

We are currently evaluating an application submitted by the City of Waco for a land-use determination for the above-referenced municipal solid waste facility. Enclosed for your review is an Application Summary. The complete application may be found posted on the internet at the following website address:
<http://www.tceq.texas.gov/permitting/waste_permits/msw_permits/msw_posted_apps.html>.

Please submit any comments you may have within thirty (30) days from the date of this letter. If you have any questions or desire additional information, please contact Mr. Eric Clegg, P.G., at (512) 239-1270, or in writing at the address on our letterhead (please include mail code MC 124 on the first line).

Sincerely,

Matthew Udenenwu, Team Leader
Municipal Solid Waste Permits Section
Waste Permits Division

MU/EJC/arm

Enclosure

P.O. Box 13087 • Austin, Texas 78711-3087 • 512-239-1000 • tceq.texas.gov

Application Summary of the

Proposed City of Waco Landfill Municipal Solid Waste Permit Application No. 2400 Land Use Compatibility Determination

Type I Municipal Solid Waste Facility McLennan and Limestone Counties, Texas

Applicant: City of Waco

Date Prepared: March 15, 2019

by the
Municipal Solid Waste Permits Section
Office of Waste, Waste Permits Division
Texas Commission on Environmental Quality

The information contained in this summary is based upon the permit application and has not been independently verified.

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Contents

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1. Applicant Contact Information

Name of Applicant:	City of Waco 401 Franklin Avenue Waco, TX 76701
Name of Facility:	City of Waco Landfill
Applicant's Contact Person:	Mr. Charles Dowdell, Director of Public Works 401 Franklin Avenue Waco, TX 76701 254-750-1601
Applicant's Consulting Engineer:	Mr. Ryan Kuntz, Vice President SCS Engineers 1901 Central Drive, Suite 550 Bedford, TX 76021 817-571-2288

2. General Information about the Application

2.1 Receipt of Application

The City of Waco has applied to the Texas Commission on Environmental Quality (TCEQ) for a permit to authorize the proposed City of Waco Landfill, a Type I municipal solid waste (MSW) landfill to be located in McLennan and Limestone Counties, Texas. Parts I and II of the application for a land-use compatibility determination were received on August 8, 2018 and declared administratively complete on September 14, 2018. A *Notice of Receipt of Application and Intent to Obtain Municipal Solid Waste Permit* (NORI) was mailed by the TCEQ Office of the Chief Clerk on October 9, 2018. This Application Summary is being provided pursuant to Texas Health and Safety Code (THSC) Chapter 361 (Solid Waste Disposal Act), Section 361.067 (Review of Permit Application by Other Governmental Entities), and Title 30, Texas Administrative Code (30 TAC), Chapter 330, Section 330.23 (Relationships with Other Governmental Entities).

2.2 Application Scope

The application is for land-use compatibility determination for a new permit for a Type I MSW landfill.

2.3 Application Structure

The land-use compatibility determination part of the permit application consists of Parts I – II only, described in 30 TAC §330.57 (relating to Permit and Registration Applications for Municipal Solid Waste Facilities). Parts I and II of the application provide information about the proposed facility, property ownership, the surrounding land use, traffic impact, waste acceptance, and location restrictions;

According to the applicant, Parts III and IV will be submitted at a later date. Part III of the application is the Site Development Plan and provides detailed information on site geology and hydrogeology, facility engineering and monitoring system designs and plans, and closure and post-closure care plans and cost estimates; and Part IV of the application is the Site Operating Plan that contains information about how the owner or operator will conduct daily operations at the facility.

2.4 Availability of Application Materials

The entire application is available for viewing and copying at the Waco-McLennan County Central Library at 1717 Austin Avenue, Waco, TX, and also may be viewed online at http://www.waco-texas.com/landfill-application-process.asp.

2.5 Attachments to this Application Summary

Maps from the permit application showing site location, nearby land use, and site development are attached to this summary.

Attachment to this Application Summary	Description	Location in Application
Attachment 1	General Location Map	Parts I/II, Figure I/II-2 General Topographic Map
Attachment 2	Facility Layout Map	Parts I/II, Figure I/II-5 Facility Layout Plan
Attachment 3	Land Use Map	Parts I/II, Appendix I/IIC, Figure LU-2

3. Part I of the Application (30 TAC §281.5, §305.45, and §330.59)

3.1 Facility Location

The facility is proposed to be located approximately 0.4 miles south of the intersection of TK Parkway and State Highway 31 in McLennan and Limestone Counties, Texas. The location is shown in Attachment 1 (General Location Map) to this Application Summary.

3.2 Access Routes

The primary access to the site is off of TK Parkway south of Hwy 31.

3.3 Coordinates and Elevation of Facility Permanent Benchmark

Latitude: N 31° 42' 05.31"

Longitude: W 96° 55' 52.07"

Elevation: Not specified

3.4 Size of Facility and Capacity of Landfill

The facility would include 502.5 acres within the proposed permit boundary, of which approximately 175.7 acres will be used for waste disposal. The maximum elevation of the final cover system and total disposal volume will be established upon receipt of Parts III and IV of the application.

3.5 Property Owner Information

The application includes a property owner affidavit signed by the mayor of the City of Waco, the property owner of record.

3.6 Evidence of Competency

The applicant has owned, operated, or had a direct financial interest in other solid waste sites. Further information about other solid waste sites owned or operated by the applicant or in which the applicant has a direct financial interest is provided in Section 16 in Parts I/II of the application.

4. Part II of the Application (30 TAC §330.61)

4.1 Sources of Wastes to be Accepted

Wastes will be accepted from the City of Waco and surrounding counties.

4.2 Type of Wastes to be Accepted

The facility will accept household waste, yard waste, commercial waste, construction-demolition waste, special waste, Class 2 non-hazardous industrial wastes, and Class 3 non-hazardous industrial wastes which includes rock, brick, glass, dirt, and certain plastics and rubber.

4.3 Wastes Prohibited or Not Authorized to be Accepted

Any other waste which is not listed in the *Type of Waste to be Accepted* section of the application, or which is prohibited by §330.15(e) may not be accepted.

4.4 Waste Acceptance Rate and Site Life

Authorized wastes will be accepted at an initial rate of approximately 1,070 tons per day and is projected to increase to an estimated maximum of 1,140 tons per day over the next five years. The estimated site life has not been reported yet. The site life may be longer if the actual waste acceptance rate is less than anticipated, or shorter if the actual waste acceptance rate is greater than anticipated.

4.5 Facility Layout

The facility layout is illustrated in Attachment 2 (Facility Layout Plan) to this Application Summary.

4.6 Land Use and Characteristics of Surrounding Area

4.6.1 Zoning and Conformance with Local Use Ordinance

The proposed facility would be located outside of the territorial limits of the City of Axtell. The application indicates that there is no zoning in the area of the facility.

4.6.2 Surrounding Land Uses within One Mile

The application indicates that 95% of the surrounding land use is classified as open, agricultural, or vacant. The remaining land is 4.1% water bodies, 0.5% residential and <0.1% commercial in the surrounding area. One cemetery is located adjacent to the site.

4.6.3 Growth Trends within Five Miles

The application indicates that the growth trends within five miles of the site ranged between 1 to 2% between 2010 and 2016.

4.6.4 Proximity to Residences and Other Uses within One Mile

There are 23 residences and one commercial business located within one mile of the permit boundary. The one historical cemetery, the TK Cemetery, is located on the western border of the site. One lake, a US Soil Conservation Reservoir is located partially on the site, to the south, however it is shown to be outside of the waste disposal footprint. The nearest residence is about 120 feet southwest of the site. There are no known schools, churches, day-care facilities, hospitals, archeologically significant sites, other historic sites, or locations of exceptional aesthetic quality within one mile of the permit boundary.

4.6.5 Known Wells within 500 Feet of the Facility

There are no wells within 500 feet of the facility, shown in Appendix I/IIB in Part I/II of the Application.

4.7 Transportation

Direct access to the facility will be from an all-weather surfaced, private road on property owned by the applicant off of TK Parkway.

Preliminary information provided in the application indicates that traffic on TK Parkway will increase approximately 30% with addition of traffic related to the proposed landfill, from 607 vehicles per day (vpd) to 857 vpd initially. The application contains a letter documenting the applicant's coordination with the Texas Department of Transportation (TXDOT) for traffic and location restrictions. A response from the Texas Department of Transportation dated August 20, 2018 indicates that the consultant coordinated with TXDOT on the traffic volumes. The applicant has submitted an additional letter to TXDOT relating to the design of site entrance/highway exit ramp area roadway improvements and is conducting a traffic impact analysis, which has not yet been submitted to TXDOT. The applicant is awaiting TXDOT's response for the design submittal.

4.8 Abandoned Oil and Water Wells

There are no known abandoned oil and water wells reported.

4.9 Texas Historical Commission Review

The applicant submitted documentation of THC review and request by THC that the applicant add an additional 25' buffer around the existing cemetery. The applicant submitted a revised plan based on the expanded buffer and is waiting on THC approval of the revised plan.

4.10 Council of Governments (COG) and Local Government Review

The application indicates that the applicant submitted Parts I/II of the application to the Heart of Texas COG (HOTCOG) and requested HOTCOG's review letter as required. HOTCOG sent a reply confirming conformance with the regional waste plan.

4.11 Location Restrictions

The application addresses location restriction provisions pursuant to Part II and Chapter 330, Subchapter M (relating to Location Restrictions) as follows.

4.11.1 Easements and Buffer Zones, §330.543

An unutilized fiber optic easement is located across the site, running west to east. The applicant has indicated that the easement will be nullified prior to construction.

The facility will maintain a minimum separating distance of 125 feet between the boundary of the facility and solid waste processing and disposal activities within the facility boundary.

No solid waste unloading, storage, disposal, or processing operations may occur within any easement, buffer zone, or right-of-way that crosses the facility. No solid waste disposal may occur within 25 feet of the center line of any utility line or pipeline easement.

4.11.2 Airport Safety, §330.545

The application indicates that there are no airports within six miles of the facility, and that the landfill is not located within 10,000 feet of any airport runway end used by turbojet aircraft or within 5,000 feet of any airport runway end used by only piston-type aircraft.

4.11.3 Floodplains, §330.547

A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) that includes the landfill facility boundary is included in the application. The map shows that a portion of the site is located within a 100-year floodplain, but that the landfill waste disposal area is located outside of the floodplain and waste disposal operations will not occur within the 100-year floodplain.

4.11.4 Groundwater and Surface Water, §330.549

The Trinity Aquifer is the major regional aquifer beneath the site, which is a Cretaceous-age unit comprised primarily of sandstone, sand, silt/clay, shale, and carbonates. Further information on the groundwater will be provided once Part III of the permit is submitted.

The site is located within the watershed of the Brazos River Basin. The major regional surface water features within the vicinity of the site include Horse Creek, Packwood Creek, and the Soil Conservation Service Site 19 Reservoir. The facility will develop a Stormwater Pollution Prevention Plan and file a Notice of Intent to comply with the TPDES Multi-Sector General Permit Number TXR 050000, as required by §402 of the federal Clean Water Act.

4.11.5 Endangered or Threatened Species, §330.551

The application includes correspondence with the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department indicating that no impacts to threatened or endangered plant or animal species are expected from the proposed operation of this facility.

Information on how the owner or operator will design the facility to protect endangered species will be provided once Parts III and IV are submitted.

4.11.6 Wetlands, §330.553

There are no jurisdictional wetland areas within the permit boundary. The applicant coordinated with the U.S. Army Corps of Engineers (USACE) and is awaiting a response from the USACE.

4.11.7 Fault Areas, §330.555

There are no known faults within 200 feet of the site in accordance with 30 TAC §330.555.

4.11.8 Seismic Impact Zones, §330.557

The facility is not located within a seismic impact zone as defined in 30 TAC §330.557.

4.11.9 Unstable Areas, §330.559

No known unstable areas, as defined in 30 TAC §330.559, were found at the site.

4.11.10 Coastal Areas, §330.561

The proposed facility is not located on a barrier island or peninsula; or within 1,000 feet of an area subject to active coastal shoreline erosion (if the area is protected by a barrier island or peninsula), or within 5,000 feet of an area subject to active coastal shoreline erosion, if the area is not protected by a barrier island or peninsula.

Application Review and TCEQ Contact Information

The application is currently being reviewed by the TCEQ Municipal Solid Waste Permits Section to determine its compliance with the applicable requirements in 30 TAC Chapters 305 and 330. Chapter 305 contains general requirements for all permit applications; Chapter 330 contains the minimum regulatory criteria for municipal solid waste facilities. If it is determined that the information in this application demonstrates compliance with these regulatory requirements and a draft order can be prepared, the application will be declared technically complete. If the application is declared technically complete, a Notice of Application and Preliminary Decision (NAPD) will be issued, along with a Technical Summary of the application.

Information about how to follow the progress of a application review, and options for public participation are available on the TCEQ website at www.tceq.texas.gov/goto/msw-type1-landfill.

For information concerning the regulations covering this application, contact:

Eric Clegg, P.G.
MSW Permits Section, MC 124
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711
(512) 239-1270

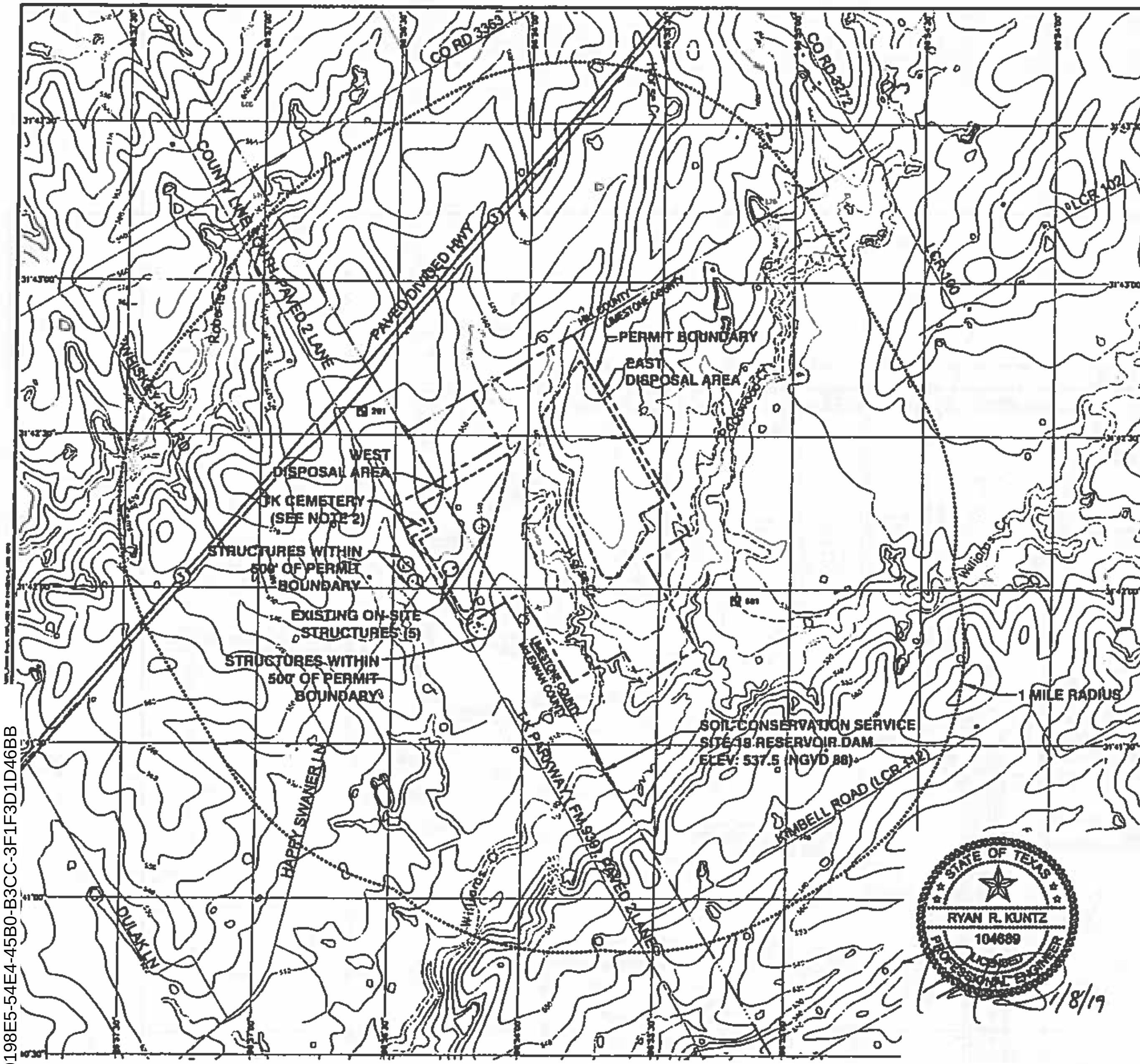
For more detailed information concerning any aspect of this application or to request a copy, please contact the Consulting Engineer or the Applicant at the address provided at the beginning of this summary.

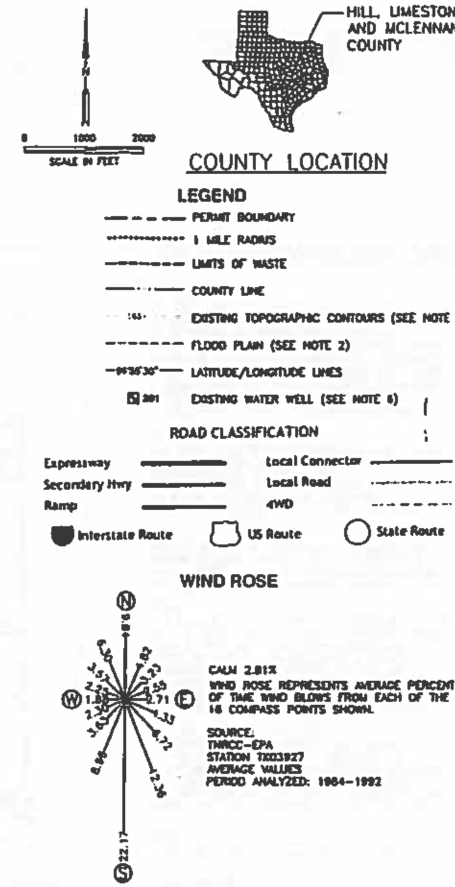
5. Attachments

Attachment 1. General Location Map (from Parts I/II, Figure I/II-2 General Topographic Map of the Application)

Attachment 2. Facility Layout Map (from Parts I/II, Figure I/II-5 Facility Layout Plan of the Application)

Attachment 3. Land Use Map (from Parts I/II, Appendix I/IIC, Figure LU-2 of the Application)





NOTES:

1. CONTOURS SHOWN ARE FROM THE 24K QUAD MAP FOR AXTELL, TEXAS (2016) PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY.
2. 100-YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11.
3. ALL KNOWN STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET OF PERMIT BOUNDARY ARE SHOWN.
4. THERE ARE NO KNOWN WATER WELLS WITHIN 500 FT. OF THE PROPOSED PERMIT BOUNDARY IN ACCORDANCE WITH PARTS I/II, SECTION 7.2.
5. BASED ON SCS' SITE INVESTIGATIONS, NO SPRINGS WERE OBSERVED ON THE SITE.
6. EXISTING WATER WELL WITHIN ONE-MILE OF PERMIT BOUNDARY (SEE ATLAS ENVIRONMENTAL RESEARCH REPORT, APPENDIX I/IIB).
7. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25-FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.

FOR PERMITTING PURPOSES ONLY

REV.	DATE	DESCRIPTION
1	12/2018	REVISION FOR PART I/II NOD 1

TEXAS BOARD OF PROFESSIONAL ENGINEERS FIRM NO. F-3407

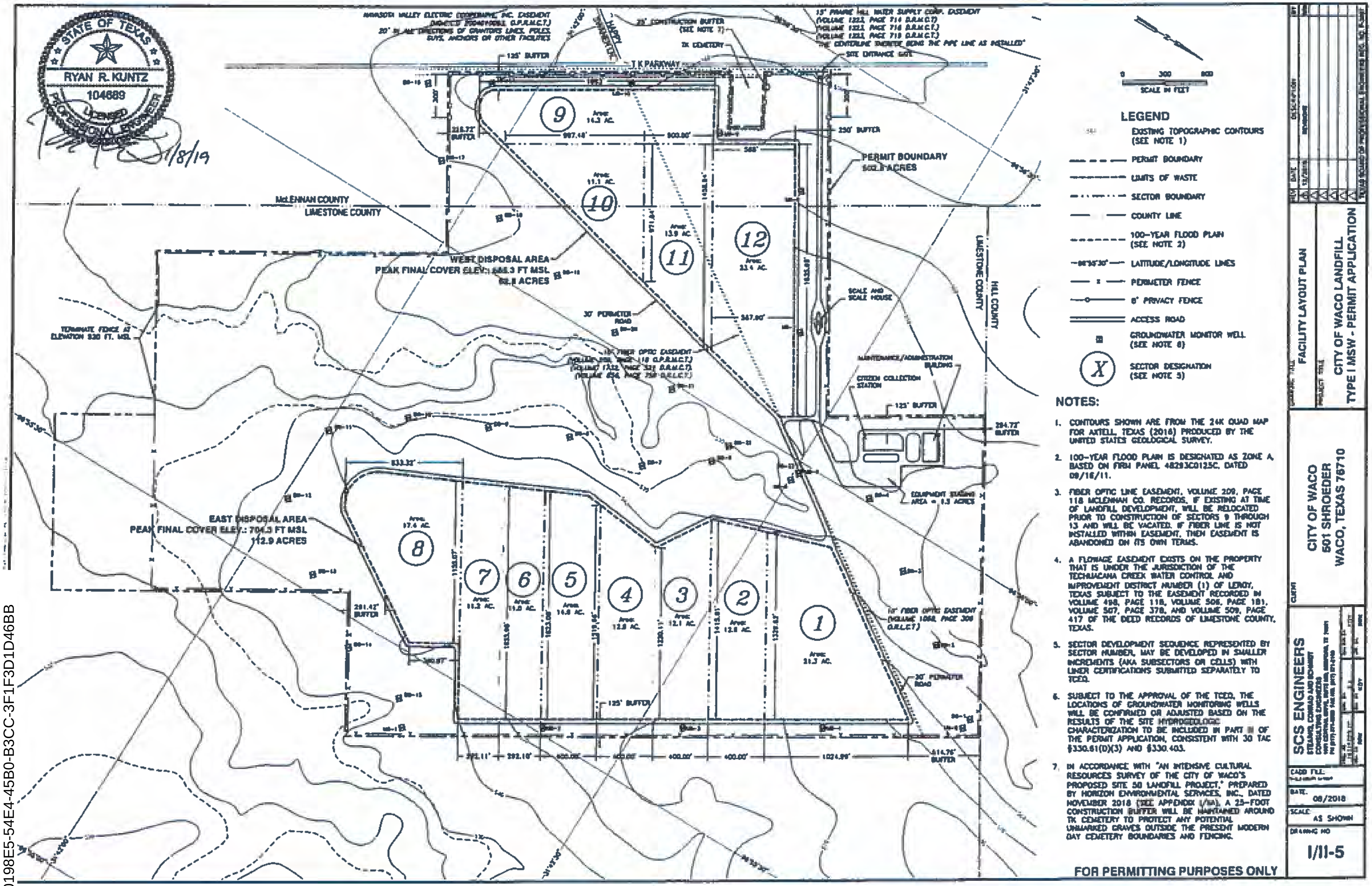
DRAWING TITLE: GENERAL TOPOGRAPHIC MAP

PROJECT TITLE: CITY OF WACO LANDFILL TYPE I MSW - PERMIT APPLICATION

CLIENT: CITY OF WACO 501 SHROEDER WACO, TEXAS 76710

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS

CADD FILE:
DATE: 08/2018
SCALE: AS SHOWN
DRAWING NO. I/II-2


STATE OF TEXAS
RYAN R. KUNTZ
104689
LICENSED
PROFESSIONAL ENGINEER
1/8/19
LEGEND
EXISTING TOPOGRAPHIC CONTOURS (SEE NOTE 1)
PERMIT BOUNDARY
LIMITS OF WASTE
SECTOR BOUNDARY
COUNTY LINE
100-YEAR FLOOD PLAIN (SEE NOTE 2)
LATITUDE/LONGITUDE LINES
PERIMETER FENCE
8' PRIVACY FENCE
ACCESS ROAD
GROUNDWATER MONITOR WELL (SEE NOTE 6)
SECTOR DESIGNATION (SEE NOTE 5)
SCALE IN FEET
NOTES:
1. CONTOURS SHOWN ARE FROM THE 24K QUAD MAP FOR AXTELL, TEXAS (2016) PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY.
2. 100-YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11.
3. FIBER OPTIC LINE EASEMENT, VOLUME 209, PAGE 118 MCLENNAN CO. RECORDS, IF EXISTING AT TIME OF LANDFILL DEVELOPMENT, WILL BE RELOCATED PRIOR TO CONSTRUCTION OF SECTORS 9 THROUGH 13 AND WILL BE VACATED. IF FIBER LINE IS NOT INSTALLED WITHIN EASEMENT, THEN EASEMENT IS ABANDONED ON ITS OWN TERMS.
4. A FLOWAGE EASEMENT EXISTS ON THE PROPERTY THAT IS UNDER THE JURISDICTION OF THE TECHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER (1) OF LEROY, TEXAS SUBJECT TO THE EASEMENT RECORDED IN VOLUME 498, PAGE 118, VOLUME 506, PAGE 181, VOLUME 507, PAGE 378, AND VOLUME 509, PAGE 417 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS.
5. SECTOR DEVELOPMENT SEQUENCE REPRESENTED BY SECTOR NUMBER, MAY BE DEVELOPED IN SMALLER INCREMENTS (AKA SUBSECTORS OR CELLS) WITH LINER CERTIFICATIONS SUBMITTED SEPARATELY TO TCEQ.
6. SUBJECT TO THE APPROVAL OF THE TCEQ, THE LOCATIONS OF GROUNDWATER MONITORING WELLS WILL BE CONFIRMED OR ADJUSTED BASED ON THE RESULTS OF THE SITE HYDROGEOLOGIC CHARACTERIZATION TO BE INCLUDED IN PART III OF THE PERMIT APPLICATION, CONSISTENT WITH 30 TAC §330.61(D)(3) AND §330.403.
7. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25-FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.
FOR PERMITTING PURPOSES ONLY
T K PARKWAY
TK CEMETERY
25' CONSTRUCTION BUFFER (SEE NOTE 7)
SITE ENTRANCE GATE
125' BUFFER
250' BUFFER
PERMIT BOUNDARY
McLENNAN COUNTY
LIMESTONE COUNTY
HILL COUNTY
WEST DISPOSAL AREA
PEAK FINAL COVER ELEV.: 686.3 FT MSL
82.8 ACRES
EAST DISPOSAL AREA
PEAK FINAL COVER ELEV.: 704.3 FT MSL
112.9 ACRES
30' PERIMETER ROAD
SCALE AND SCALE HOUSE
MAINTENANCE/ADMINISTRATION BUILDING
CITIZEN COLLECTION STATION
EQUIPMENT STAGING AREA = 1.5 ACRES
TERMINATE FENCE AT ELEVATION 530 FT. MSL
9
10
11
12
8
7
6
5
4
3
2
1
FACILITY LAYOUT PLAN
CITY OF WACO LANDFILL
TYPE I MSW - PERMIT APPLICATION
CITY OF WACO
501 SHROEDER
WACO, TEXAS 76710
SCS ENGINEERS
DATE: 08/2018
SCALE: AS SHOWN
I/II-5

JOHN WORRALL CONSULTING

LEGEND

Permit Boundary
Limits of Fill
1 Mile Radius from Permit Boundary

LAND USE

(Within 1 Mile of Permit Boundary)

Other: Open, Agricultural, Vacant, Floodplain
Residential (23 units)
Water Bodies
Cemetery (1)
Commercial (1 unit)

- All roadways unpaved except as indicated
- No churches, schools, daycare centers, or parks within 1 mi. of permit boundary.
- No historic sites (per THC database) within 1 mi. of permit boundary.

Figure LU-2

LAND USE - 1 MILE

CITY OF WACO LANDFILL (TYPE I)

NORTH

DATA SOURCES:
Aerial Photograph: Google Earth January, 2017
Site Inventory: April 2, 2018
April 17 2018

0 1000' 2000' 3000' 4000' 5000'
GRAPHIC SCALE IN FEET

,7190436Ā-6:25782Ā/,)Ā+(%*"!+"Ā$,%$Ā$.*$Ā+" (Ā& + '&&$,#,#

Texas Department of Transportation

125 EAST 11TH STREET, AUSTIN, TEXAS 78701-2483 | 512.463.8588 | WWW.TXDOT.GOV

March 25, 2020

Jim Reed
City of Waco
P.O. Box 2570
Waco, Texas 76702-2570

Dear Mr. Reed,

TxDOT has reviewed the information provided by SCS on August 7, 2018, and confirms that the City has coordinated with TxDOT for the proposed landfill, including traffic and location restrictions. In response, by letter dated August 20, 2018, TxDOT provided the volume of traffic on access roads within one mile of the facility.

In addition, TxDOT also reviewed the schematic plan prepared by Walker Partners, for improvements to FM 939 between Highway 31 and the proposed landfill entrance, and has no objection to the City constructing those improvements, subject to the normal approval process for construction in TxDOT's right-of-way.

The Traffic Impact Analysis (TIA) prepared by John Denholm, P.E. with Lee Engineering, dated January 7, 2020 was reviewed, and TxDOT confirms that the TIA addressed all comments and questions regarding the adequacy and design capacity of access roads to safely accommodate the additional volumes and weights of traffic generated or expected to be generated by the facility operation contingent upon the construction of the improvements shown within the schematic prepared by Walker Partners.

As noted in the TIA and in discussions with the City, TxDOT is planning to construct overpass structures at the intersections of Highway 31 at FM 939 and FM 2311. The construction of these overpasses is anticipated to be completed by April 2022. TxDOT is partnering with the City so that the improvements shown in the Walker Partners' schematic can be constructed in the same construction contract as the overpass project. These improvements will be 100% funded by the City, but TxDOT will maintain oversight concerning design details, specifications, and material call outs.

TxDOT has no objection to the construction of the landfill project, or the road improvements described in the TIA and Walker Partners' schematic, and the project does not need screening or special operating requirements. Prior to issuing an access permit, TxDOT will review and approve proposed site plans to include driveway locations, spacing, and dimensions as well as a site drainage plan for this installation.

Sincerely,

DocuSigned by:
B69BD796DD564C9...
Stan Swiatek, P.E.
District Engineer – Waco District

COORDINATION WITH FEDERAL AVIATION ADMINISTRATION

Revision 3

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2018-ASW-13879-OE

Issued Date: 03/10/2020

Ryan Kuntz
SCS Engineers
1901 Central Drive
Suite 550
Bedford, TX 76021

**** Extension ****

A Determination was issued by the Federal Aviation Administration (FAA) concerning:

Structure:	Landfill City of Waco Landfill TCEQ Permit No.MSW-2400
Location:	Leroy, TX
Latitude:	31-42-26.30N NAD 83
Longitude:	96-55-12.60W
Heights:	554 feet site elevation (SE) 150 feet above ground level (AGL) 704 feet above mean sea level (AMSL)

In response to your request for an extension of the effective period of the determination, the FAA has reviewed the aeronautical study in light of current aeronautical operations in the area of the structure and finds that no significant aeronautical changes have occurred which would alter the determination issued for this structure.

Accordingly, pursuant to the authority delegated to me, the effective period of the determination issued under the above cited aeronautical study number is hereby extended and will expire on 09/10/2021 unless otherwise extended, revised, or terminated by this office. You must adhere to all conditions identified in the original determination.

This extension issued in accordance with 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerns the effect of the structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (817) 222-5933, or andrew.hollie@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2018-ASW-13879-OE.

Signature Control No: 384454990-433127925 (EXT)
Andrew Hollie
Specialist

Attachment(s)
Additional Information
Case Description

Additional information for ASN 2018-ASW-13879-OE

All provisions remain the same.

Case Description for ASN 2018-ASW-13879-OE

The proposed landfill will be a Type I MSW landfill with a permit boundary of 502.5 acres. The waste disposal footprint will encompass 175.7 acres, separated into two disposal areas. The landfill will provide disposal waste types authorized by TCEQ.

FAA File No. 2018-013-TX

APPENDIX I/IIC

LAND-USE ANALYSIS

LAND USE ANALYSIS

City of Waco Landfill
Type I Facility

May 8, 2019

Prepared by:
John Worrall Consulting LLC
509 Camino Barranca
Round Mountain, TX 78663
830.825.3029

Introduction

The City of Waco Landfill is proposed as a Type I municipal solid waste facility. The proposed facility encompasses approximately 502.6 acres and is to be developed in a rural area in Limestone and McLennan Counties, approximately 15 miles northeast of the city of Waco. (refer also to Figure LU-1).

The purpose of this land use evaluation is to address land use issues as required by TCEQ in support of an application for TCEQ municipal solid waste facility authorization for the City of Waco Landfill. Specifically, this evaluation addresses those portions of TCEQ rules pertaining to land use compatibility. The relevant rule portions, as excerpted from 30 Texas Administrative Code ("TAC") § 330.61, are:

> *(g) Land-use map. This is a constructed map of the facility showing the boundary of the facility and any existing zoning on or surrounding the property and actual uses (e.g., agricultural, industrial, residential, etc.) both within the facility and within one mile of the facility. The owner or operator shall make every effort to show the location of residences, commercial establishments, schools, licensed day-care facilities, churches, cemeteries, ponds or lakes, and recreational areas within one mile of the facility boundary…*
>
> *(h) Impact on surrounding area. A primary concern is that the use of any land for a municipal solid waste facility not adversely impact human health or the environment. The owner or operator shall provide information regarding the likely impacts of the facility on cities, communities, groups of property owners, or individuals by analyzing the compatibility of land use, zoning in the vicinity, community growth patterns, and other factors associated with the public interest. To assist the commission in evaluating the impact of the site on the surrounding area, the owner or operator shall provide the following:*
>
> > *(1) if available, a published zoning map for the facility and within two miles of the facility for the county or counties in which the facility is or will be located. If the site requires approval as a nonconforming use or a special permit from the local government having jurisdiction, a copy of such approval shall be submitted;*
> >
> > *(2) information about the character of surrounding land uses within one mile of the proposed facility;*
> >
> > *(3) information about growth trends within five miles of the facility with directions of major development;*
> >
> > *(4) the proximity to residences and other uses (e.g., schools, churches, cemeteries, historic structures and sites, archaeologically significant sites, sites having exceptional aesthetic quality, etc.) within one mile of the facility. The owner or operator shall provide the approximate number of residences and commercial establishments within one mile of the proposed facility including the distances and directions to the nearest residences and commercial establishments. Population density and proximity to residences and other uses described in this paragraph may be considered for assessment of compatibility…*

List of Figures

Zoning

Because the site is not in an incorporated area, there is no zoning at the site. Moreover, the site is more than two miles from any incorporated city; hence there is no zoning within two miles.

The site is not within the extraterritorial jurisdiction of any incorporated city and is therefore not subject to the subdivision regulations of any city. The site does not require approval as a nonconforming use or a special permit from any local government.

Character of Surrounding Land Uses

The predominant land use within one mile of the permit boundary is classified as *Other (open, agricultural, vacant, floodplain).* This land use comprises 95.3 % of the land area within one mile of the facility boundary (refer also to Figure LU-2). Nearly all of this open land is agricultural pasture lands or wooded floodplain lands.

Land use within one mile is specifically characterized as follows:

Land Use	Acres	Percentage	Remarks
Other	4257	95.3	Open, agric., vacant, floodplain
Water Bodies	184	4.1	January, 2017 surface area
Residential	23	0.5	23 residences
Commercial	1	< 0.1	1 establishment
Cemetery	1	< 0.1	1 cemetery
Total	4466 ac	100 %	not including permit boundary

Source: Field Inventories, April 2 and April 17, 2018

There are approximately 184 acres of *Water Bodies* within one mile of the permit boundary, representing approximately 4.1% of the area within one mile. The two largest water bodies are Soil Conservation Service Reservoirs; the remainder are stock tanks or ornamental water features. (Water surface area was calculated based on January 2017 aerial photography.)

All of the *Residential* land (23 estimated acres) is rural, single-family residential, consisting of 23 residences and representing an estimated 0.5% of the land area within one mile of the permit boundary. (In the case of rural residences, one acre is attributed to each residence.)

Commercial land use (one establishment estimated at one acre) makes up less than 0.1% of the land area within one mile of the permit boundary.

Cemetery land use is one cemetery estimated at one acre, less than 0.1% of the land area within one mile of the permit boundary.

Growth Trends

The permit boundary for the City of Waco Landfill straddles the McLennan and Limestone County lines, immediately south of Hill County. Recent population estimates for these three counties are indicated below.

Population Growth, by County

	2010	2016	% Change
McLennan County	234,906	252,626	7.5%
Limestone County	23,384	24,104	3.1%
Hill County	35,089	35,621	1.5%

Source: Texas Demographic Center, UT-San Antonio

Anchored by the City of Waco, McLennan County is clearly the dominant county in terms of population size and growth. For purposes of comparison, the State of Texas grew 10.3% from 2010 through 2016.

Figure LU-3 depicts growth trends within five miles of the site, as well as regional growth trends, for the period of 2012 through 2017. Within five miles of the site, population growth in the census block groups immediately north and south of the site grew by less than 1%, from 2012 through 2017 (an increase of 14 persons). Immediately east and west of the site, the census block groups grew at less than 2% from 2012 through 2017 (an increase of 52 persons).

Within the region, the highest growth is occurring within those census block groups either within or west of Waco.

Proximity

As of April 2018, there are 23 residences within one mile of the facility boundary. The nearest residence to the proposed facility is at 4418 TK Parkway, estimated to be approximately 265 feet south of the permit boundary, and approximately 485 feet south of the limit of fill.

There is one business establishment within one mile of the permit boundary; Southern Cross Whitetail Ranch, on TK Parkway, approximately 650 feet southwest of the permit boundary and 775 feet southwest of the limit of fill

There is one cemetery (TK Cemetery) within one mile of the permit boundary, located on TK Parkway. The cemetery adjoins the western permit boundary and is 125 feet west and north of the limit of fill.

The Texas Historic Sites Atlas of the Texas Historical Commission does not identify any historic sites or structures or any archaeological sites within one mile of the facility boundary. Horizon Environmental Services prepared a Cultural Resources Archival Review of the site and vicinity and notes that one previously recorded archaeological site is present within one mile, and no historic properties. (Refer elsewhere in application for more detailed information.)

There are no hospitals, churches, daycare centers, schools, recreational areas, or sites having exceptional aesthetic quality within one mile of the facility boundary.

APPENDIX I/IID

TRAFFIC ANALYSIS

APPENDIX I/IID-1

TxDOT WACO DISTRICT TRAFFIC MAP

APPENDIX I/IID-2

TRAFFIC IMPACT ANALYSIS

Texas Department of Transportation

125 EAST 11TH STREET, AUSTIN, TEXAS 78701-2483 | 512.463.8588 | WWW.TXDOT.GOV

March 25, 2020

Jim Reed
City of Waco
P.O. Box 2570
Waco, Texas 76702-2570

Dear Mr. Reed,

TxDOT has reviewed the information provided by SCS on August 7, 2018, and confirms that the City has coordinated with TxDOT for the proposed landfill, including traffic and location restrictions. In response, by letter dated August 20, 2018, TxDOT provided the volume of traffic on access roads within one mile of the facility.

In addition, TxDOT also reviewed the schematic plan prepared by Walker Partners, for improvements to FM 939 between Highway 31 and the proposed landfill entrance, and has no objection to the City constructing those improvements, subject to the normal approval process for construction in TxDOT's right-of-way.

The Traffic Impact Analysis (TIA) prepared by John Denholm, P.E. with Lee Engineering, dated January 7, 2020 was reviewed, and TxDOT confirms that the TIA addressed all comments and questions regarding the adequacy and design capacity of access roads to safely accommodate the additional volumes and weights of traffic generated or expected to be generated by the facility operation contingent upon the construction of the improvements shown within the schematic prepared by Walker Partners.

As noted in the TIA and in discussions with the City, TxDOT is planning to construct overpass structures at the intersections of Highway 31 at FM 939 and FM 2311. The construction of these overpasses is anticipated to be completed by April 2022. TxDOT is partnering with the City so that the improvements shown in the Walker Partners' schematic can be constructed in the same construction contract as the overpass project. These improvements will be 100% funded by the City, but TxDOT will maintain oversight concerning design details, specifications, and material call outs.

TxDOT has no objection to the construction of the landfill project, or the road improvements described in the TIA and Walker Partners' schematic, and the project does not need screening or special operating requirements. Prior to issuing an access permit, TxDOT will review and approve proposed site plans to include driveway locations, spacing, and dimensions as well as a site drainage plan for this installation.

Sincerely,

DocuSigned by:
B69BD796DD564C9...
Stan Swiatek, P.E.
District Engineer – Waco District

TRAFFIC ANALYSIS FOR PROPOSED MSW FACILITY

Prepared for:
CITY OF WACO
300 AUSTIN AVENUE
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Prepared by:

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January 2020

STATE OF TEXAS
JOHN P. DENHOLM III
97330
LICENSED
PROFESSIONAL ENGINEER

John Denholm, III
1/7/20

January 7, 2020
PROJECT T1857.01

EXECUTIVE SUMMARY

The purpose of this traffic study is to determine the adequacy of the surrounding transportation infrastructure with respect to the proposed City of Waco MSW facility to be located east of FM 939 and south of SH 31 in McLennan and Limestone Counties, Texas. The facility will provide municipal solid waste disposal, and recyclable drop-off services to residents of the City of Waco and businesses in the City and surrounding areas.

Background traffic counts were collected in 2018 on the surrounding roadway network and then grown for use in the traffic analysis. Year 2018, 2024 (projected site opening) and 2059 (projected facility closure/design life) analyses are presented in this study. The total traffic analysis added the predicted peak hour traffic from the proposed site to the surrounding roadways during the AM peak hour, PM peak hour, and the anticipated site peak hour.

Based on the results of this study for the City of Waco MSW Facility, the following conclusions are made:

- The proposed site is predicted to generate 884 trips per day when the facility is anticipated to open in 2024, including employee trips. 1,358 trips per day are predicted during year 2059 operations when the site is anticipated to reach its design life.

- Roadway link capacity analyses for the year 2024 and 2059 for the surrounding roadways indicate that adequate capacity will be available to serve the additional traffic generated by the future operations of the proposed MSW Facility along with assumed background growth.

- Intersection capacity analysis indicates that the study intersections are anticipated to operate at acceptable levels of service for predicted background and total traffic operations in 2024 and 2059.
- The City of Waco is planning to improve the section of FM 939 between SH 31 and the facility entrance. These improvements include the following:
    1. A structural overlay on the two-lane road (to the extent required after future TxDOT improvements along FM 939 are in place);
    2. Adding eight-foot shoulders on both sides of the road;
    3. Adding a southbound left-turn lane for vehicles entering the facility access; and
    4. Adding a northbound right-turn lane for vehicles entering the facility access.

- The City of Waco is planning to construct a westbound acceleration lane and yellow/red flashing beacons and intersection illumination on SH 31 despite the relatively low predicted left-turn volumes
    1. Lee Engineering recommends that the City coordinate with TxDOT such that the acceleration lane is only constructed if it will have a suitable lifespan. The need for the acceleration lane is eliminated if an overpass is constructed at the intersection of SH 31 and FM 939

- No additional changes to the surrounding roadway network are recommended to accommodate the site traffic generated by the predicted operations of the City of Waco MSW Facility.

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INTRODUCTION

The purpose of this traffic study is to determine the adequacy of the surrounding transportation infrastructure with respect to the proposed disposal operations at the City of Waco MSW facility to be located east of Farm-to-Market Road 939 (FM 939) and south of State Highway 31 (SH 31) in McLennan and Limestone Counties, Texas. The facility is designed to provide municipal solid waste disposal, and recyclable drop-off services to residents of the City of Waco and businesses in the City and surrounding areas.

The primary access route to the facility is via the proposed site access driveway on FM 939. The proposed driveway will be located approximately 2,048 feet south of eastbound SH 31. The existing Waco facility is open from 7:00 AM to 5:00 PM Monday through Saturday. It is likely that the proposed facility will operate similar hours; however, hours may shift in response to operating needs. **Figure 1** presents a vicinity map that depicts the general location of the proposed facility and the surrounding roadway network. A preliminary site plan is included in the appendix.

TCEQ Municipal Solid Waste Regulations require data and analysis for the expected life of the facility – currently estimated to be the year 2059. Other transportation industry organizations recommend shorter planning horizons. Peak traffic of 174 peak hour trips are estimated to occur in the year 2059 during the final year waste is projected to be received for disposal at the landfill.

Two analysis scenarios for the proposed facility are addressed as part of this study:

- Scenario 1: Assumed Site Opening Year (2024)
- Scenario 2: Peak Year Operations in the Year 2059 Prior to Site Closure

Figure 1. Vicinity Map

The study area for this traffic study is based on a review of likely access routes within one mile of the facility. A brief description of the existing area roadways selected for study is provided below:

Farm-to-Market Road 939 (FM 939) – FM 939 (or T K Parkway) is a two-lane undivided asphalt roadway with a posted speed limit of 60 mph in the vicinity of the site. FM 939 is classified as a Collector on the City of Waco *Master Thoroughfare Plan* (2012). Based on TxDOT's *Statewide Planning Map*, FM 939 is classified as a Major Collector. The proposed site will have one (1) full-access site driveway along FM 939 approximately 2,048 feet south of SH 31.

TxDOT let for construction in January 2019 a project to implement roadway improvements along FM 939 south of SH 31. The existing roadway is approximately 22.5 feet wide. The TxDOT project will improve the roadway surface to approximately 30 feet wide, with 12-foot lanes and 3-foot shoulders in each direction.

In addition to the TxDOT improvements currently under construction, the City of Waco is planning to improve the section of FM 939 between SH 31 and the facility entrance. These improvements include the following:

- A structural overlay on the two-lane road (to the extent required after future TxDOT improvements along FM 939 are in place);
- Adding eight-foot shoulders on both sides of the road; and
- Adding a southbound left-turn lane for vehicles entering the facility access.
- Adding a northbound right-turn lane for vehicles entering the facility access.

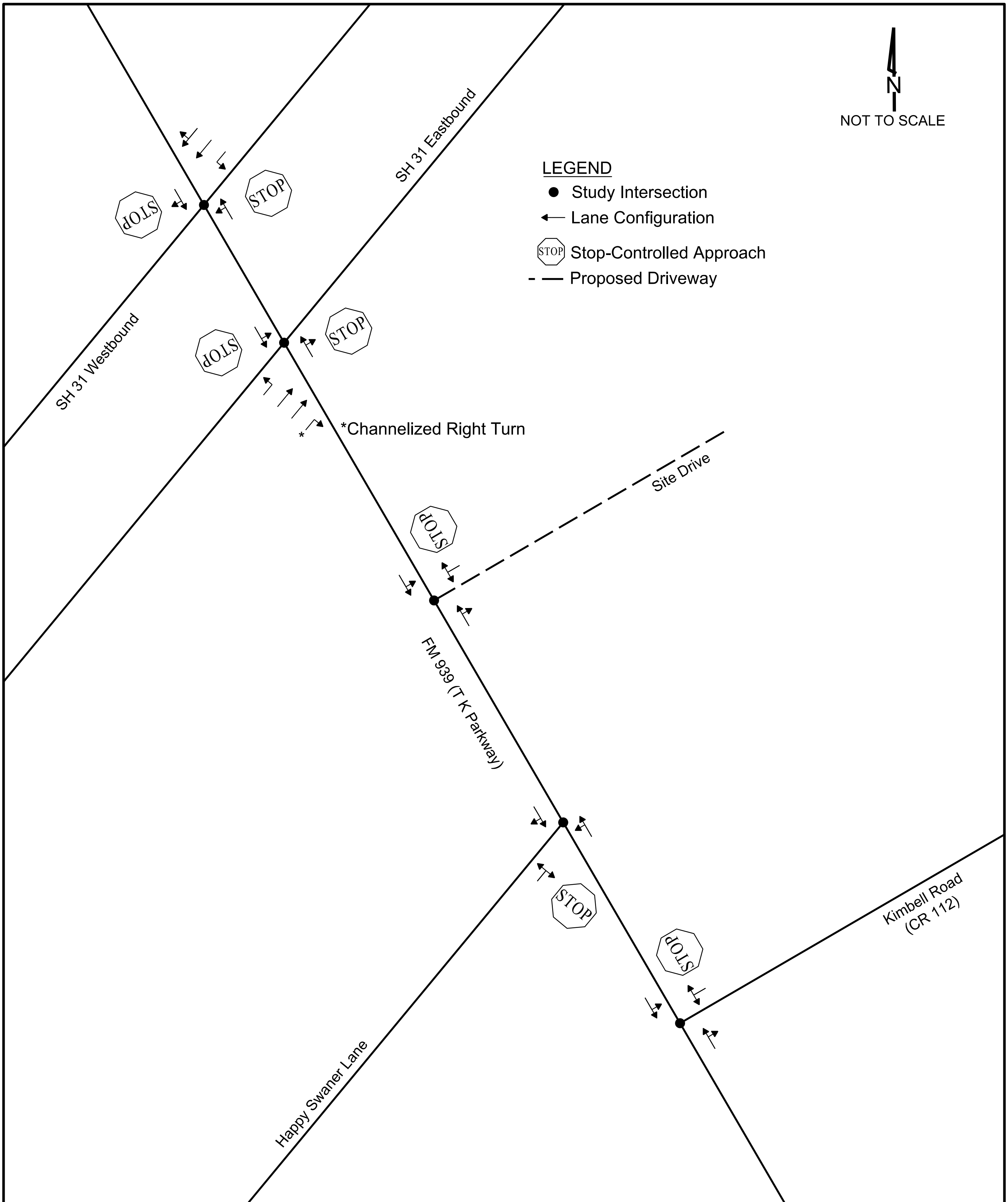
The existing FM 939 roadway has a weight restriction of 58,420 pounds gross vehicle weight. Based on information provided during coordination with TxDOT, the improvements to FM 939 let in January 2019 and scheduled for completion in April 2020 consist of a reconstructed pavement structure. Upon completion of the TxDOT project, the newly constructed FM 939 pavement will be re-evaluated, and the load zoning will likely be removed. If the resulting load restriction is less than 80,000 pounds then the City of Waco will construct a structural overlay from SH 31 to the facility entrance.

State Highway 31 (SH 31) – SH 31 is currently a four-lane divided roadway with a posted speed limit of 75 mph. Speed data was collected on SH 31 on October 30, 2018. Based on this data, the 85th percentile speed on SH 31 was 73 mph in the eastbound direction and 80 mph in the westbound direction. Raw data is included in the Appendix. SH 31 is classified as a Principal Arterial on the City of Waco *Master Thoroughfare Plan* (2012). Based on TxDOT's *Statewide Planning Map*, FM 939 is classified as a Principal Arterial. The intersections of eastbound SH 31 at FM 939 and westbound SH 31 at FM 939 are both stop-controlled on the FM 939 approaches. The SH 31 median is approximately 225 feet wide at FM 939, with SH 31 constructed to allow for operation as a future diamond interchange if a grade separation is constructed. No overpass is currently included in the regional long-range plans based on discussions with TxDOT and the City of Waco and so was not assumed to be in place for this analysis. Construction of the overpass would improve the projected traffic operations presented in this study. If no overpass is likely to be constructed within the first few years of operation, Waco is proposing to construct an acceleration lane westbound on SH 31 from FM 939 if approved by TxDOT.

Happy Swaner Lane – Happy Swaner Lane is a two-lane undivided roadway with no posted speed limit which intersects FM 939 approximately 1,500 feet south of the proposed site access point. Happy Swaner Lane is an asphalt roadway with no curb and gutter. Happy Swaner Lane is classified as a local roadway on the City of Waco *Master Thoroughfare Plan* (2012) in the vicinity of the study area. An occasional private passenger vehicle may use this roadway to travel to the facility, but Happy Swaner Lane will not serve as a primary access route to the facility due to the land use and transportation network in the area. The City of Waco will prohibit its waste collection and transfer vehicles traveling to or from the facility from utilizing Happy Swaner Lane unless and until the roadway is improved and a memorandum of understanding is executed with the counties regarding the maintenance and use of the roadway. Happy Swaner Lane has been included in the analysis to be conservative due to its proximity to the facility.

Kimbell Road (County Road 112) – Kimbell Road is currently a two-lane undivided roadway with no posted speed limit which intersects FM 939 approximately 1.5 miles south of Happy Swaner Lane. From the stop bar to the start of gravel, the roadway is asphalt for approximately 75 feet. The roadway is then gravel for 615 feet and then becomes asphalt again. Kimbell Road (CR 112) is classified as a local roadway on the City of Waco *Master Thoroughfare Plan* (2012). An occasional private passenger vehicle may use this roadway to travel to the facility, but Kimbell Road is unlikely to serve as a primary access route to the facility due to the land use and transportation network in the area. As currently constructed, Kimbell Road does not appear to have an adequate pavement surface for waste collection vehicles. The City of Waco will prohibit its waste collection and transfer vehicles traveling to or from the facility from utilizing Kimbell Road unless and until the roads are improved and a memorandum of understanding executed with the counties regarding the maintenance and use of the roadway. Kimbell Road has been included in the analysis to be conservative due to proximity to the facility.

The existing intersection lane configurations, existing traffic control, and the proposed driveway location are shown in **Figure 2**.



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Existing Intersection Lane Configurations and Proposed Site Driveway Location

Figure 2

EXISTING TRAFFIC VOLUMES

Twenty-four-hour turning movement traffic volumes were collected at the intersection of SH 31 and FM 939 on Tuesday, October 30, 2018. Twenty-four hour turning movement volumes were also collected at the remaining study intersections on Wednesday, December 5, 2018. The collected directional volumes in the study area are summarized in **Table 1**.

Table 1: Traffic Volumes Collected

Roadway	Daily Volume	Direction[1]	AM Peak Hour	PM Peak Hour	10:00 AM to 11:00 AM
SH 31 – West of FM 939	6,192	EB	144	307	135
		WB	322	225	172
SH 31 – East of FM 939	6,069	EB	150	294	134
		WB	305	220	169
FM 939 – North of SH 31	101	NB	3	6	2
		SB	8	7	2
FM 939 – SH 31 to Happy Swaner Lane	576	NB	46	26	10
		SB	25	36	9
FM 939 –Happy Swaner Lane to Kimbell Road	590	NB	41	25	7
		SB	19	37	12
FM 939 – South of Kimbell Road	565	NB	35	25	7
		SB	18	36	11
Happy Swaner Lane – West of FM 939	83	EB	2	4	2
		WB	12	4	1
Kimbell Road – East of FM 939	25	EB	2	2	2
		WB	1	0	0

[1] NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

In addition to the roadway AM and PM peak hours, the 10:00 AM to 11:00 AM hour is presented in the table because the City of Waco MSW Facility's peak traffic volumes are anticipated to occur during that time period (Facility Peak Hour).

Daily approach volumes and peak hour turning movement volumes for Existing (2018) conditions are shown in **Figure 3**.

Finally, existing gap data was collected on SH 31 on Tuesday, October 30, 2018. All raw traffic data is included in the Appendix.

BACKGROUND TRAFFIC VOLUMES

Lee Engineering gathered TxDOT historical count volumes at locations near the proposed site. These volumes are presented in **Table 2** below. As can be seen from the historical data, there have been fluctuations in traffic volumes near the proposed site over the past several years.

Table 2: TxDOT Count Map Volumes

TxDOT Count Year		FM 939 South of US 84	SH 31 East of FM 939	SH 31 West of FM 939
2011		670	5,300	6,000
2012		500	5,300	5,600
2013		593	4,204	5,667
2014		698	4,795	5,276
2015		817	4,721	5,202
2016		757	5,526	5,950
2017		622	5,888	6,254
Average Annual Growth	**2011-2017**	**-1%**	**2%**	**1%**
	2012-2017	**4%**	**2%**	**2%**

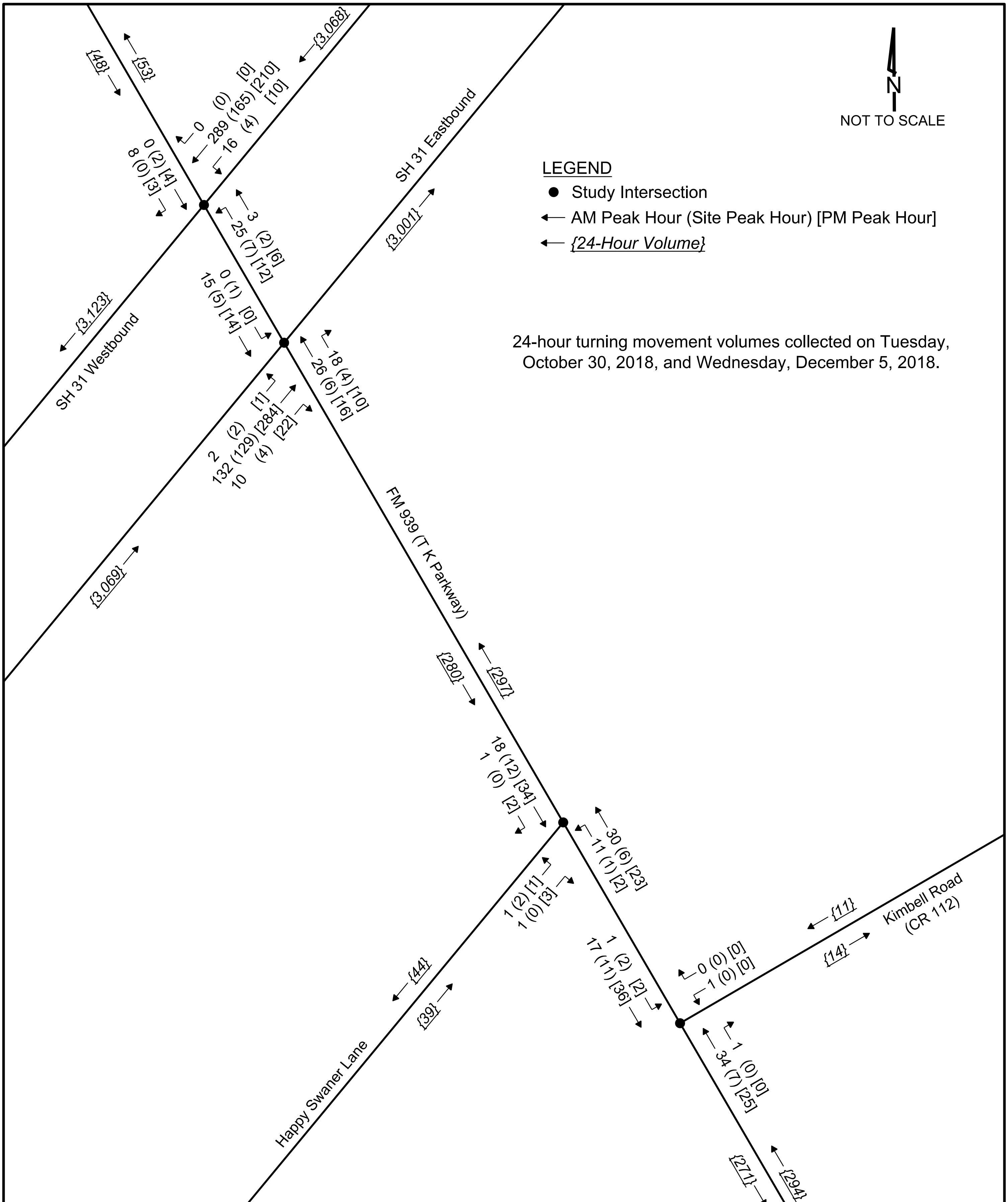
In the TxDOT Statewide Planning Map, projections for 2037 traffic volumes are available for the study roadways. Based on that data, TxDOT projected annual growth percentages of 2.6% on Kimbell Road and 1.7% on all the other study roadways.

Finally, in the TxDOT schematic for the FM 939 reconstruction project, TxDOT provided estimated daily volumes on FM 939 of 1,880 in 2017 and 2,800 in 2037, representing an annual growth rate of 2% per year.

For the purposes of this study, an annual traffic volume growth rate of two percent (2%) was selected to estimate background traffic volumes in the analysis years (2024 and 2059).

To calculate the Site Opening (2024) Background traffic volumes, the existing traffic volumes (Figure 3) were grown at an annual rate of two percent (2%) for six years. The projected Site Opening (2024) Background traffic volumes are shown in **Figure 4**.

To calculate the Site Closure (2059) Background traffic volumes, the existing traffic volumes (Figure 3) were grown at an annual rate of two percent (2%) for 41 years. The projected Site Closure (2059) Background traffic volumes are shown in **Figure 5**.



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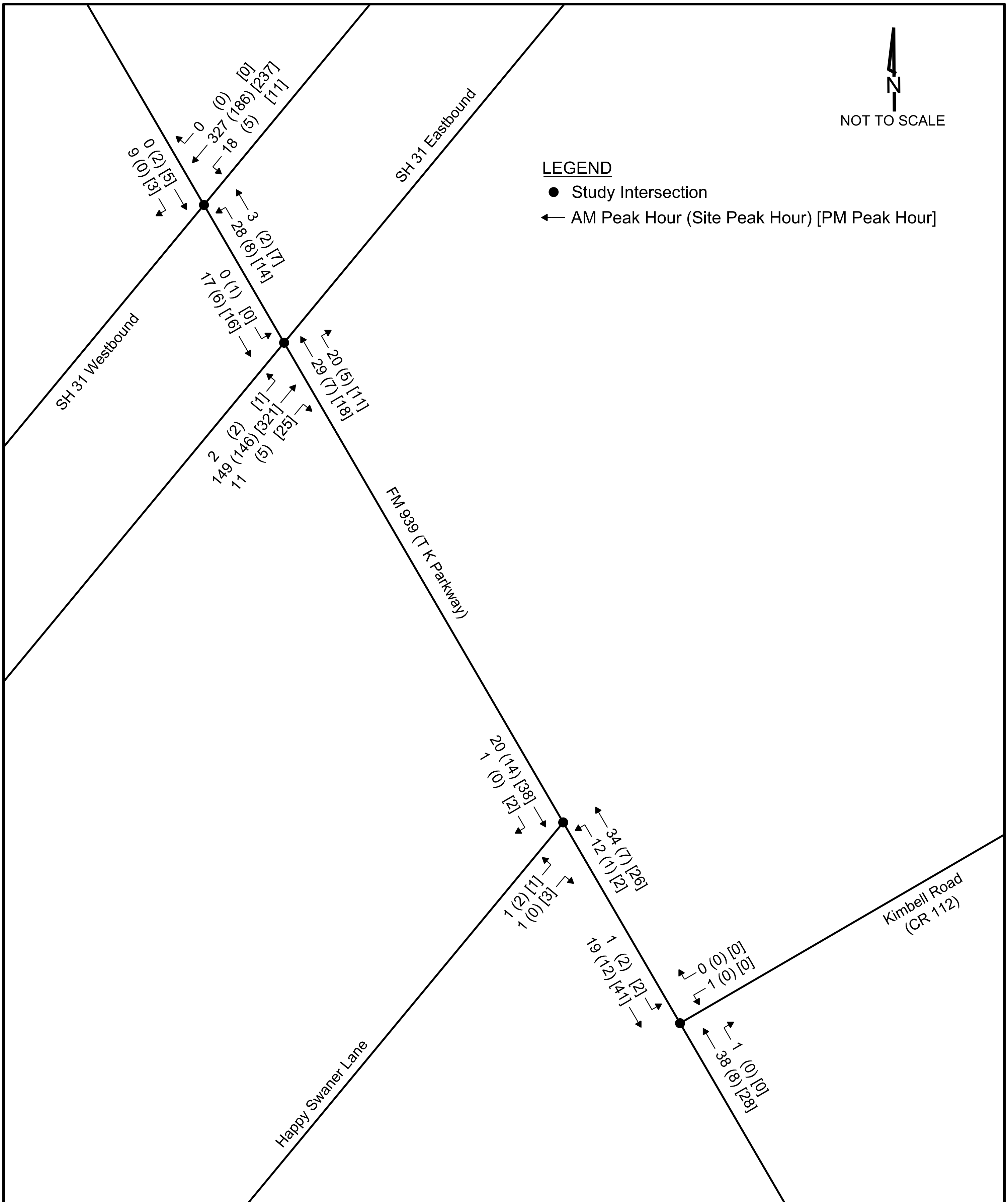
Existing (2018) Peak Hour and Daily Traffic Volumes

Figure 3



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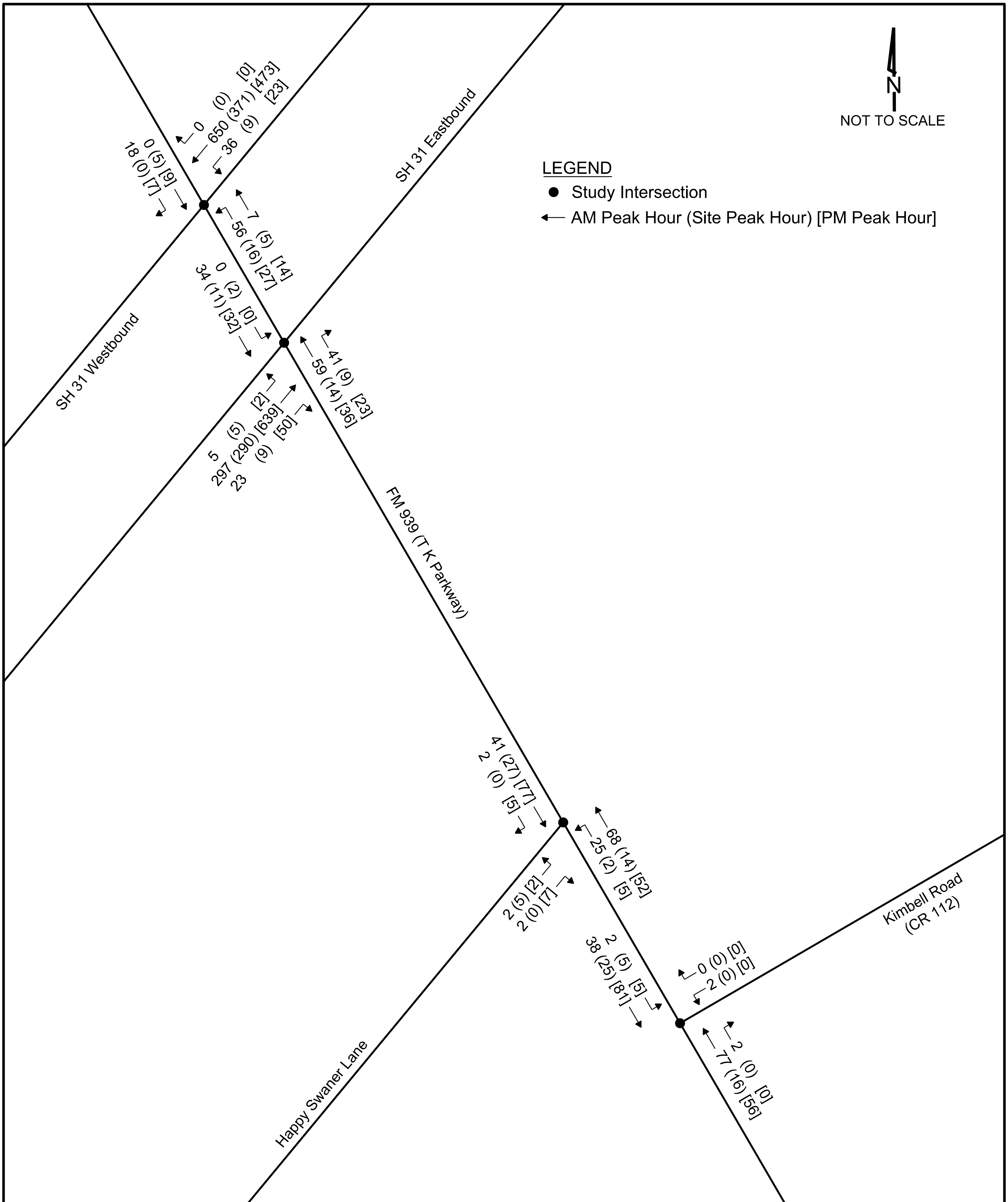
Site Opening (2024) Background
Peak Hour Traffic Volumes

Figure 4



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Site Closure (2059) Background
Peak Hour Traffic Volumes

Figure 5

TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

City of Waco representatives provided the average inbound number of vehicles accessing the existing Waco landfill facility in each hour of the day, based on data collected between September 2017 and August 2018. Information was provided for both weekday operation and weekend operation and is included in the Appendix. The City also provided estimated daily volumes at the proposed site between the assumed opening year (2024) and the assumed closure year (2059), which is also included in the Appendix. Based on this information, the site is anticipated to have 411 inbound daily trips in 2024 and 634 inbound daily trips in 2059. It was assumed that the same number of exiting trips would occur over the course of the day.

It was determined that the best indicator of anticipated traffic volumes is the volume of traffic at the existing landfill, increasing over time at the rate of anticipated population growth. This is because landfill traffic is driven not by the size or capacity of the landfill, but by the demand for service in the area and the proximity of other landfills to the population. The landfill will be moving from an area of high population to an area of lower population, so basing the opening traffic volume of the facility on the existing traffic volume of the existing landfill is considered conservative. The rate of anticipated population growth of 1.25% per year was taken from the population growth for McLennan County provided in Attachment I/IIC. For further detail, see Page 65 in the appendix.

Based on information provided by the City of Waco, the facility is not expected to generate a large amount of traffic during construction of the site. The City has indicated that daily construction traffic will be lower than daily traffic associated with normal operations. Additionally, the majority of natural materials used in the construction of the facility will come from within the facility boundary. As a result, no analysis specific to facility construction is presented in this report because the daily operations analyzed represent the more conservative analysis case.

Lee Engineering collected entering and exiting traffic volumes at the existing Waco landfill site south of the city for a six-day period. Based on the average weekday vehicles counts, Lee Engineering calculated the percentage that the number of vehicles for each hour period represents as a portion of the entire day. These hourly percentages were then used in identifying the peak hours and the hourly volumes. A summary of the collected data is shown in **Table 3**.

Based on the hourly break down provided in Table 3, the 10:00 AM to 11:00 AM hour is assumed as the Facility Peak Hour. This peak hour does not coincide with the typical 7:00 AM to 9:00 AM morning or 4:00 PM to 6:00 PM evening peak periods on typical roadway facilities. It should be noted that the facility generates relatively low traffic volumes during the 4:00 PM to 6:00 PM peak period (less than 10 percent of the facility traffic) and is unlikely to have a significant impact during that time period. Some of the light vehicles accessing the site are likely staff vehicles.

Table 3: Hourly Traffic Breakdown – Existing Site South of Waco

	AVERAGE WEEKDAY VOLUMES							% of Daily
	Light Vehicles		Single-Unit Trucks		Articulated Trucks		TOTAL VOLUME (VPH)	
Time	In	Out	In	Out	In	Out		
12:00 AM	0	0	0	0	0	0	0	0.0%
1:00 AM	0	0	0	0	0	0	0	0.0%
2:00 AM	0	0	0	0	0	0	0	0.0%
3:00 AM	0	0	0	0	0	0	0	0.0%
4:00 AM	0	0	0	0	0	0	0	0.0%
5:00 AM	0	0	0	0	0	0	0	0.0%
6:00 AM	9	2	5	0	1	0	17	2.2%
7:00 AM	14	6	14	12	1	1	48	6.1%
8:00 AM	27	18	14	12	1	3	75	9.5%
9:00 AM	24	20	21	16	1	2	84	10.6%
10:00 AM	27	27	19	20	1	1	95	12.0%
11:00 AM	22	23	19	20	1	1	86	10.9%
12:00 PM	19	23	18	17	2	1	80	10.1%
1:00 PM	17	16	22	24	0	1	80	10.1%
2:00 PM	22	19	21	19	1	1	83	10.5%
3:00 PM	20	24	11	17	1	2	75	9.5%
4:00 PM	8	20	9	12	1	0	50	6.3%
5:00 PM	1	10	0	1	0	0	12	1.5%
6:00 PM	1	1	0	0	0	0	2	0.3%
7:00 PM	0	1	0	0	0	0	1	0.1%
8:00 PM	1	0	0	0	0	0	1	0.1%
9:00 PM	0	0	0	0	0	0	0	0.0%
10:00 PM	0	0	0	0	0	0	0	0.0%
11:00 PM	0	0	0	0	0	0	0	0.0%
Total	212	210	173	170	11	13	789	100.0%

As previously stated, the site was anticipated to have 411 inbound vehicle trips in 2024 and 634 inbound vehicle trips in 2059. The above daily distribution was applied to the projected daily inbound volume to obtain hourly inbound and outbound trips. It was assumed that an equal number of vehicles would enter and exit the site every hour.

Finally, based on information from City of Waco representatives, the site will include 30 employees in 2024 and 45 employees in 2059. For the purposes of this study, the employees were split into two shifts, with half entering the site from 7:00 AM-8:00 AM and half entering from 10:00 AM-11:00 AM. Employees were assumed to depart the site in the ninth hour after entering. Some of the employees are likely to arrive in the hour prior to facility opening. Based on information from City of Waco representatives, approximately 7 to 8 employees typically enter the facility during the 6:00 AM hour and 7 to 8 employees arrive during the 7:00 AM hour. However, combining all the employees arriving during the 6:00 AM and 7:00 AM hours into the 7:00 AM arrival hour for analysis purposes results in a more conservative analysis of traffic operations by adding more employee traffic during the peak hour of the adjacent roadway (7:00 AM). Similarly the other half of employees have been shown entering during the 10:00 AM hour resulting in a more conservative analysis of traffic operations by adding employee traffic during the peak hour of the facility itself (10:00 AM). The estimated hourly site traffic volumes entering and exiting the site are shown in Table 4. The shaded rows indicated site traffic volumes added during the AM peak hour and the PM peak hour of the adjacent roadways, along with the site peak hour.

Table 4: Estimated Hourly Site Traffic Volumes in the Analysis Years

Time	% of Daily	Estimated Total Non-Employee Trips		2024 Employees		2059 Employees		2024 Trips (VPH)			2059 Trips (VPH)		
		2024	2059	In	Out	In	Out	In	Out	Total	In	Out	Total
6:00 AM	2.2%	18	28					9	9	18	14	14	28
7:00 AM	6.1%	50	78	15		23		40	25	65	62	39	101
8:00 AM	9.5%	78	120					39	39	78	60	60	120
9:00 AM	10.6%	88	134					44	44	88	67	67	134
10:00 AM	12.0%	98	152	15		22		64	49	113	98	76	174
11:00 AM	10.9%	90	138					45	45	90	69	69	138
12:00 PM	10.1%	84	128					42	42	84	64	64	128
1:00 PM	10.1%	84	128					42	42	84	64	64	128
2:00 PM	10.5%	86	134					43	43	86	67	67	134
3:00 PM	9.5%	78	120					39	39	78	60	60	120
4:00 PM	6.3%	52	80		15		23	26	41	67	40	63	103
5:00 PM	1.5%	12	20					6	6	12	10	10	20
6:00 PM	0.3%	2	4					1	1	2	2	2	4
7:00 PM	0.1%	2	2		15		22	1	16	17	1	23	24
8:00 PM	0.1%	2	2					1	1	2	1	1	2
9:00 PM – 6:00 AM	0.0%	0	0					0	0	0	0	0	0
Total	100.0%	824	1268	30	30	45	45	442	442	884	679	679	1,358

Based on the facility specific hourly data, the facility generates the most traffic during the 10:00 AM to 11:00 AM peak hour when 12 percent of the daily facility traffic occurs. During the 2024 analysis year, approximately 113 trips are estimated to occur during the facility peak hour, with 64 vehicles arriving at the facility and 49 vehicles expected to leave the facility. During the 2059 analysis year, approximately 174 trips are estimated to occur during the facility peak hour, with 98 vehicles arriving at the facility and 76 vehicles expected to leave the facility. These volumes include all vehicles entering the complex including both light and heavy vehicles as well as employee vehicles.

TOTAL TRAFFIC VOLUMES

Trip Distribution

The distribution and assignment of site generated trips to the study area roadways and intersections were performed based on the local traffic patterns, knowledge of the study area, and the proposed location of the site access point. The majority of the site traffic was assumed to go to and come from the Waco city limits to the southwest. The City of Waco will require all City operated vehicles to access the site from SH 31. The assumed directional distribution percentages for the proposed development are shown in **Figure 6**.

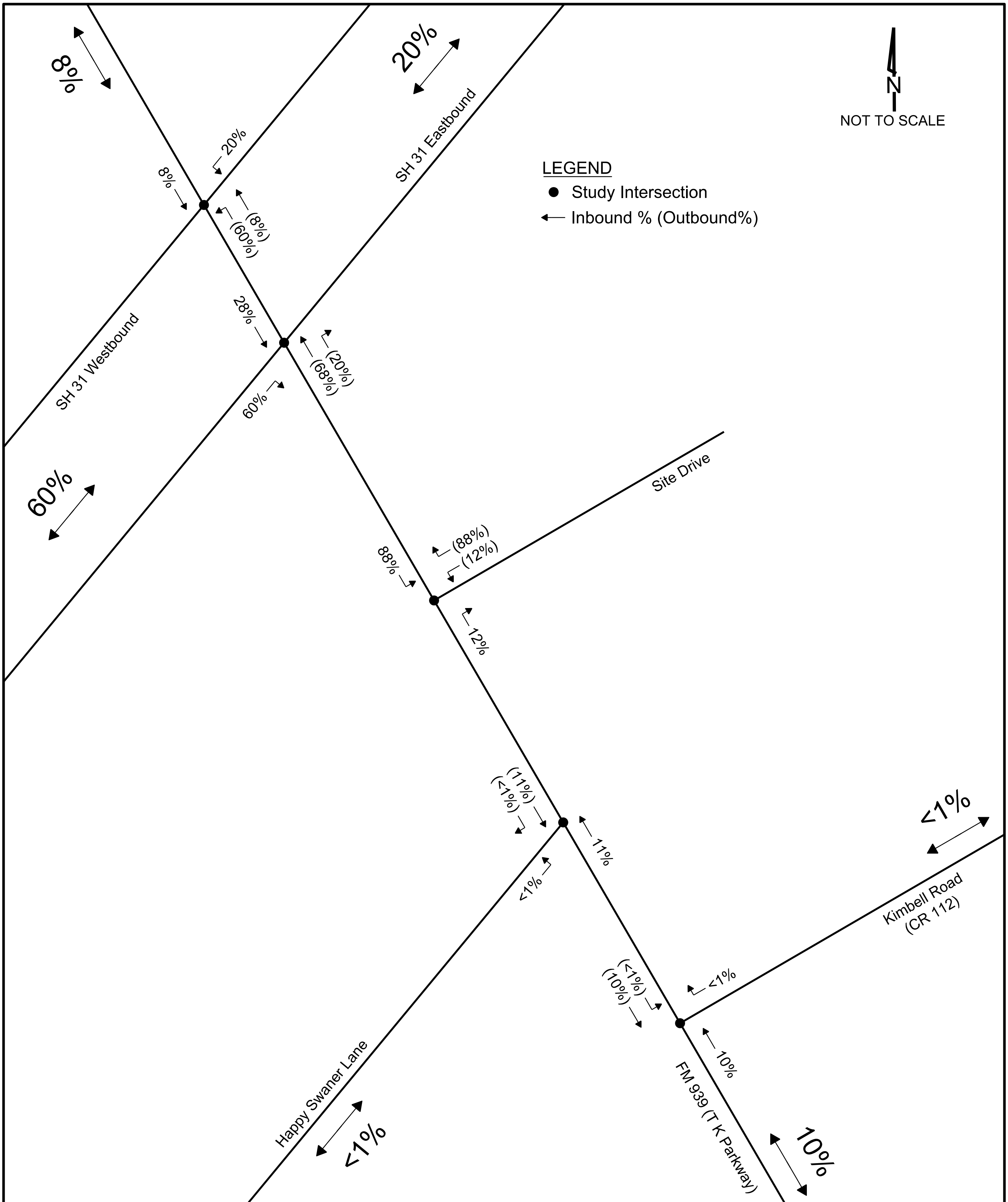
Site Traffic Assignment

Traffic volumes expected to be generated by the proposed development were assigned to the area roadways and site access point based on the assumed directional distribution identified in Figure 6. The estimated site generated traffic volumes for Site Opening (2024) of the development are shown in **Figure 7** during the weekday AM peak, site peak, and PM peak hours. Similarly, the estimated site generated traffic volumes for Site Closure (2059) are shown in **Figure 8** during the weekday AM peak, site peak, and PM peak hours. The entering and exiting site traffic volumes for each scenario were previously identified in Table 4.

Projected Total Traffic Volumes

To obtain the projected total traffic volumes at Site Opening (2024), the estimated 2024 site generated traffic volumes (Figure 7) were added to the 2024 background traffic volumes (Figure 4). The projected total traffic volumes for Site Opening (2024) are shown in **Figure 9**.

Similarly, to obtain the projected total traffic volumes at Site Closure (2059), the estimated 2059 site generated traffic volumes (Figure 8) were added to the 2059 background traffic volumes (Figure 5). The projected total traffic volumes for Site Closure (2059) are shown in **Figure 10**.



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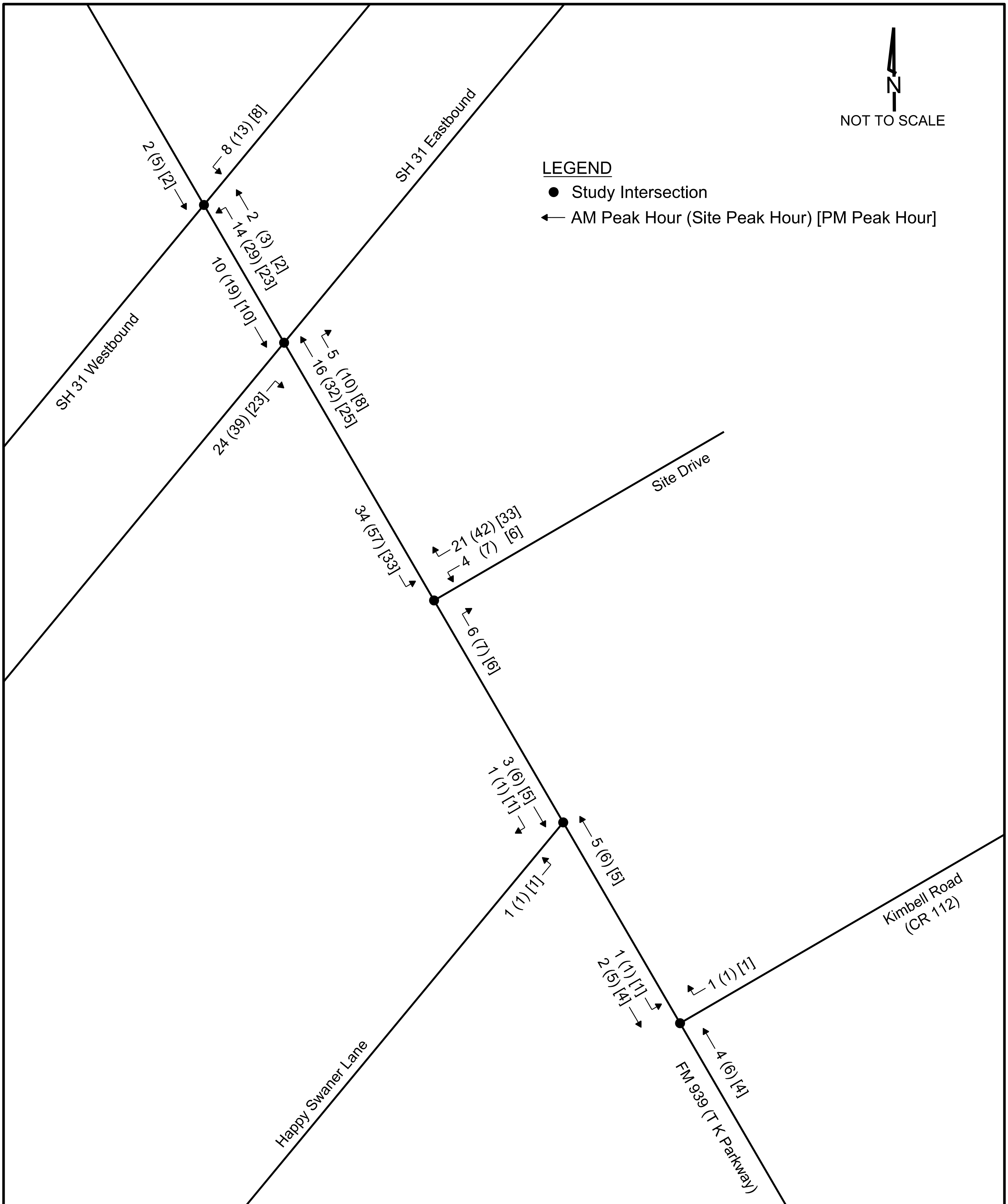
Assumed Directional Distribution

Figure 6



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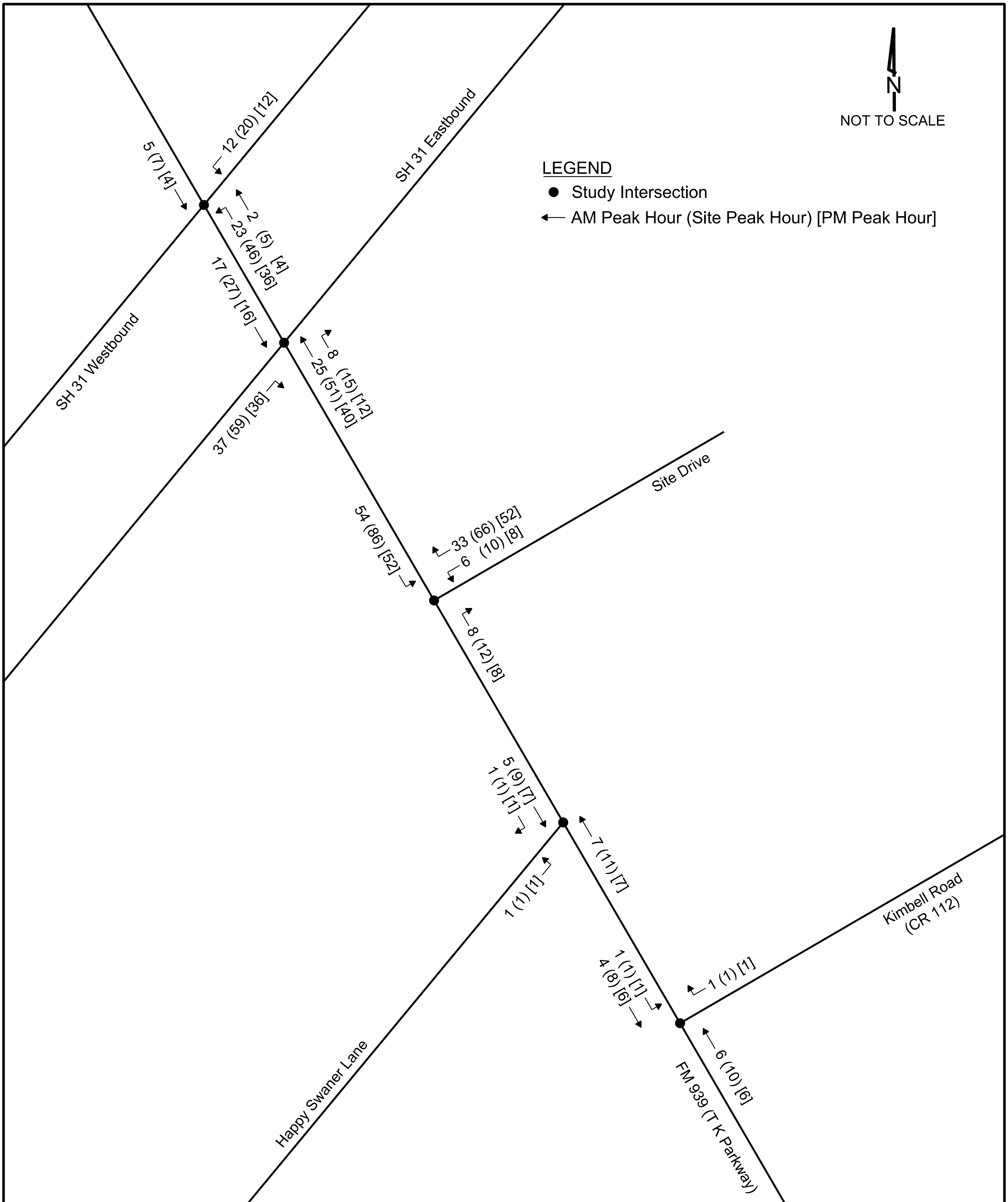
Site Opening (2024) - Site Generated Traffic Volumes

Figure 7



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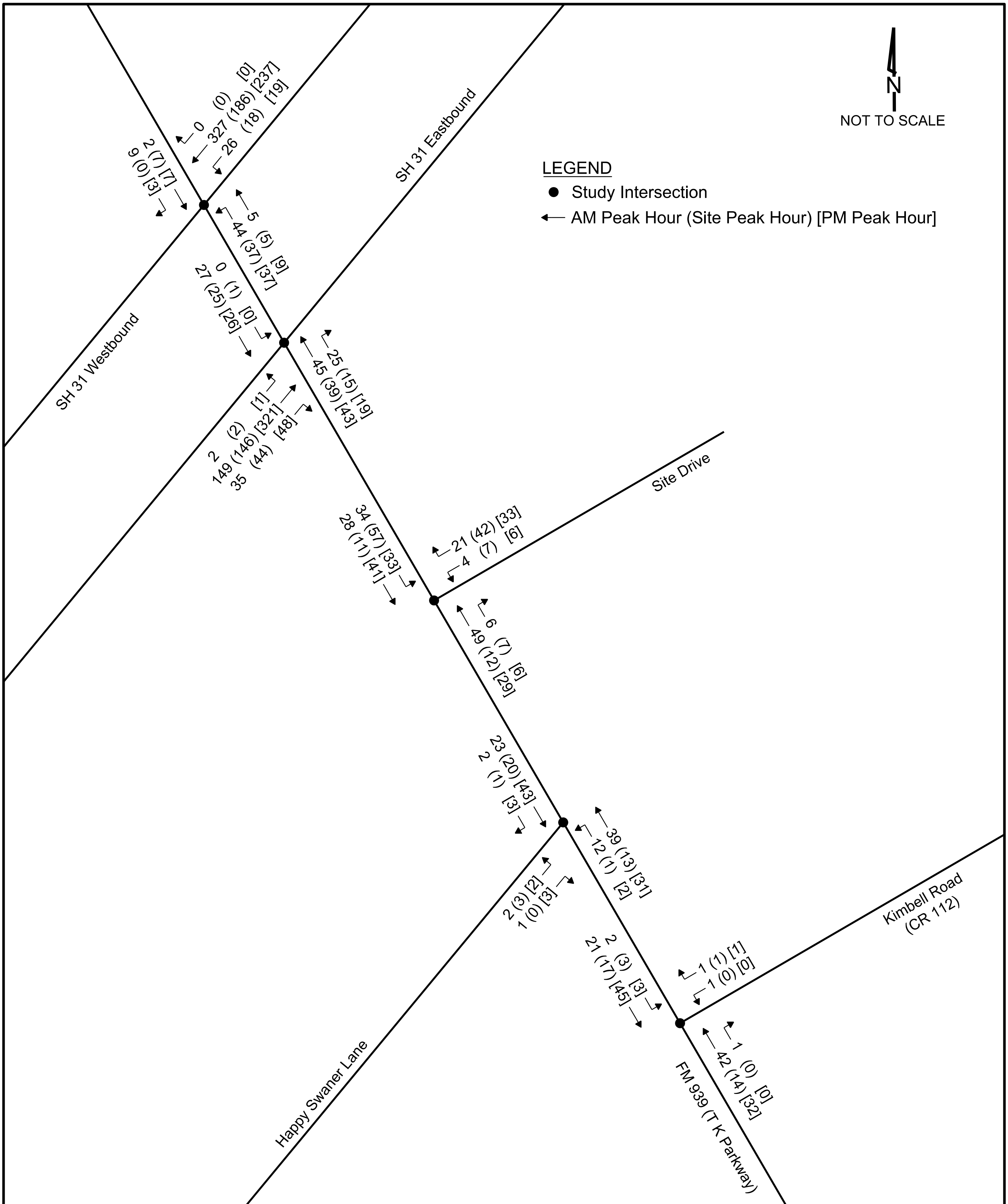
Site Closure (2059) - Site Generated Traffic Volumes

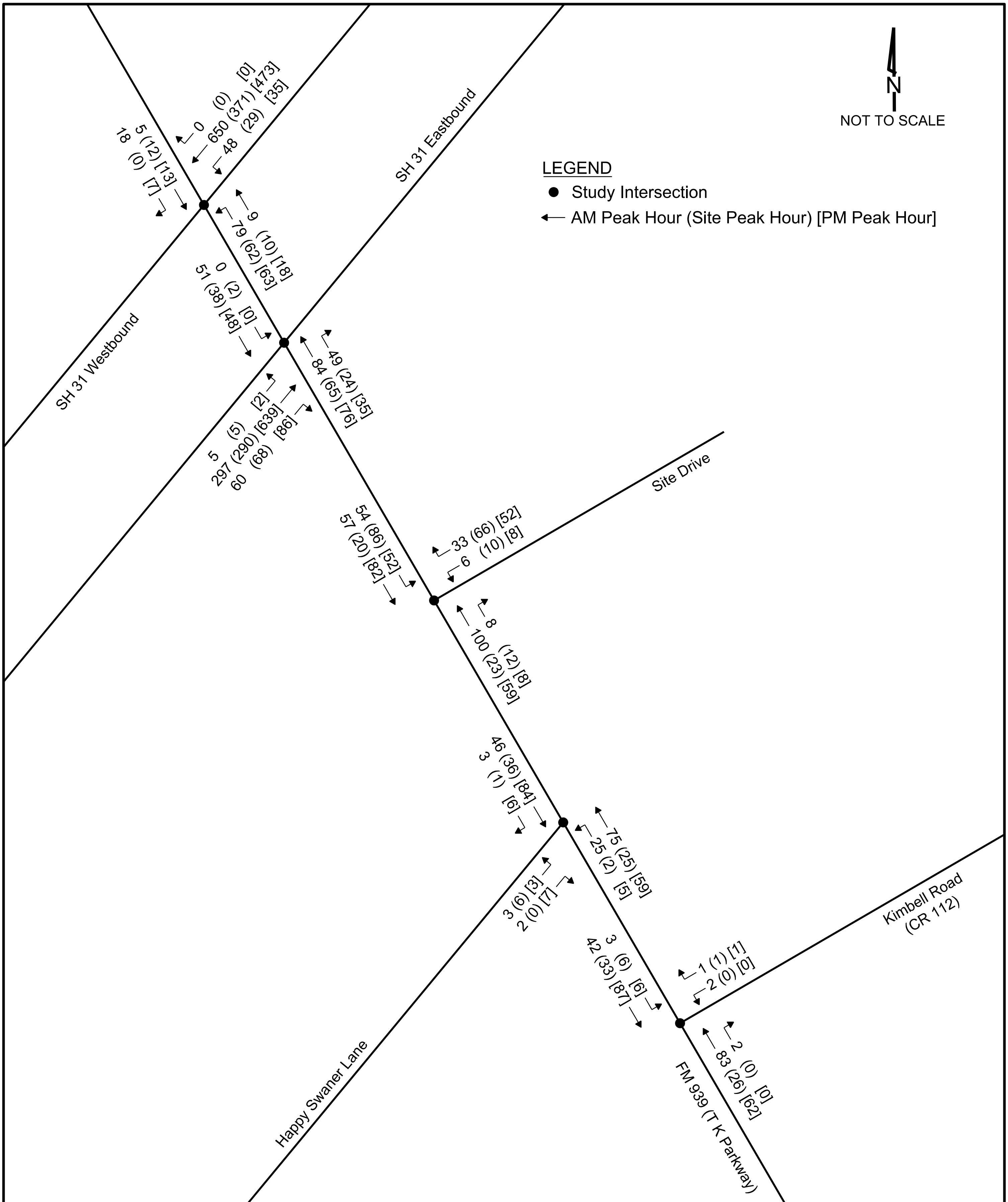
Figure 8



3030 LBJ FREEWAY
SUITE 1660
DALLAS, TEXAS 75234
972-248-3006 FAX 972-248-3855
LEE ENGINEERING

Site Opening (2024) Total
Peak Hour Traffic Volumes

Figure 9



3030 LBJ FREEWAY
SUITE 1660
DALLAS, TEXAS 75234
972-248-3006 FAX 972-248-3855
LEE ENGINEERING

Site Closure (2059) Total
Peak Hour Traffic Volumes

Figure 10

TRAFFIC ANALYSES

Roadway Link Analysis

Planning level roadway link capacity analysis allows for the assessment of a roadway's ability to adequately serve the projected traffic volumes by comparing projected volumes to the service volume or capacity, of that roadway.

The *Highway Capacity Manual* provides methodology for analyzing the operation on uninterrupted-flow facilities. HCM defines levels of service for automobiles on two-lane highways such as FM 939 based on the follower density (in followers per mile), as shown in **Table 5**. Criteria also differs based on the posted speed limit of the facility. For a multi-lane highway segment, such as SH 31, HCM defines levels of service for automobiles based on density (in passenger cars per mile per lane), as shown in **Table 6**.

Table 5: Level of Service Criteria for Two-Lane Highways

Level-of-Service (LOS)	Follower Density (followers/mile)	
	Higher-Speed Highways Posted Speed Limit ≥50 mph	Lower-Speed Highways Posted Speed Limit <50 mph
A	≤ 2.0	≤ 2.5
B	> 2.0 to 4.0	> 2.5 to 5.0
C	> 4.0 to 8.0	> 5.0 to 10.0
D	> 8.0 to 12.0	> 10.0 to 15.0
E	> 12.0	> 15.0
F	LOS F exists when demand exceeds capacity.	

SOURCE: *Highway Capacity Manual 6th Edition,* Transportation Research Board, 2016.

Table 6: Level of Service Criteria for Multilane Highways

Level-of-Service (LOS)	Density (pc/mi/ln)
A	≤ 11
B	> 11 to 18
C	> 18 to 26
D	> 26 to 35
E	> 35 to 45
F	> 45 or v/c > 1.0

SOURCE: *Highway Capacity Manual 6th Edition,* Transportation Research Board, 2016.

The *Highway Capacity Manual* defines levels of service for automobiles within a range from “A” to “F” with “A” being free-flow, higher-speed, low-density operation and “F” being a dense traffic stream with constrained or congested operations.

Roadway link analysis was performed using the methodologies in McTrans *HCS 7* software for the following scenarios:

- Existing (2018) Traffic Volumes;
- Site Opening (2024) Background Traffic Volumes;
- Site Closure (2059) Background Traffic Volumes;
- Site Opening (2024) Total Traffic Volumes; and
- Site Closure (2059) Total Traffic Volumes.

Roadway link analysis was performed for FM 939 between SH 31 and Happy Swaner Lane, with the results shown in **Table 7**. *HCS 7* output sheets are included in the Appendix for each scenario. For the ‘Total’ traffic scenarios, two roadway segments were included: FM 939 between SH 31 and the Site Drive and FM 939 between the Site Drive and Happy Swaner Lane. FM 939 was considered a higher-speed two-lane highway for this analysis. As shown, FM 939 is anticipated to operate at LOS A between SH 31 and Happy Swaner Lane for all scenarios.

Roadway link analysis was also performed for SH 31 west of FM 939, as most site traffic volumes were routed this direction. Results are shown in **Table 8** and *HCS 7* output sheets are included in the Appendix. SH 31 was considered a multilane highway for this analysis. As shown, SH 31 is anticipated to operate at LOS A west of FM 939 for all scenarios.

Table 7: Two-Lane Highway Analysis – FM 939 between SH 31 and Happy Swaner Lane

Scenario		Direction	AM Peak Hour			PM Peak Hour			Facility Peak 10:00 AM to 11:00 AM		
			Volume	Follower Density[1]	LOS	Volume	Follower Density[1]	LOS	Volume	Follower Density[1]	LOS
2018 Existing		NB	46	0.1	A	26	0.0	A	10	0.0	A
		SB	25			36			9		
2024 Background		NB	49	0.1	A	29	0.1	A	12	0.0	A
		SB	28			41			11		
2059 Background		NB	100	0.3	A	59	0.2	A	23	0.0	A
		SB	57			82			20		
2024 Total	SH 31 to Site Drive	NB	70	0.2	A	62	0.2	A	54	0.2	A
		SB	62			76			69		
	Site Drive to Happy Swaner Lane	NB	55	0.1	A	35	0.1	A	19	0.0	A
		SB	32			47			18		
2059 Total	SH 31 to Site Drive	NB	133	0.5	A	111	0.5	A	89	0.4	A
		SB	111			134			106		
	Site Drive to Happy Swaner Lane	NB	108	0.4	A	67	0.2	A	35	0.1	A
		SB	63			90			30		

[1] Follower Density in followers per mile

Table 8: Multilane Highway Analysis –SH 31 West of FM 939

Scenario	Direction	AM Peak Hour			PM Peak Hour			Facility Peak 10:00 AM to 11:00 AM		
		Volume	Density[1]	LOS	Volume	Density[1]	LOS	Volume	Density[1]	LOS
2018 Existing	EB	144	1.5	A	307	2.9	A	135	1.6	A
	WB	322	3.8	A	225	2.7	A	172	1.8	A
2024 Background	EB	162	1.7	A	347	3.3	A	153	1.8	A
	WB	364	4.4	A	254	3.0	A	194	2.0	A
2059 Background	EB	325	3.5	A	691	6.6	A	304	3.5	A
	WB	724	8.7	A	507	6.1	A	387	4.0	A
2024 Total	EB	186	2.1	A	370	3.8	A	192	2.8	A
	WB	380	4.9	A	277	3.5	A	223	2.6	A
2059 Total	EB	362	4.1	A	727	7.4	A	363	5.4	A
	WB	747	9.7	A	543	6.8	A	433	5.1	A

[1] Density in passenger cars per mile per lane

Facility Percent of Daily Traffic

For reference, the estimated average daily facility generated traffic was compared to the total daily roadway volume and the resulting percentage of facility traffic along each link was calculated, as shown in **Table 9**. The data indicate that for the majority of roadways the facility traffic would constitute less than 10 percent of traffic on that roadway. South of the site, facility traffic accounts for approximately 12 percent of the total daily traffic on FM 939. Due to the low existing traffic volumes between the site driveway and SH 31, the facility site traffic is anticipated to account for approximately half of the total daily traffic on FM 939. However, the section of FM 939 from SH 31 to the facility is only 2,048 feet in length and will be improved by the City of Waco prior to opening the facility. North of SH 31, the facility is anticipated to account for approximately 35 percent of the daily traffic on FM 939. Again, existing traffic volumes on FM 939 are very low.

Table 9: Total Facility Traffic as a Percentage of Daily Traffic

Roadway	Background Traffic			Site Traffic		Site Traffic Percent of Total Daily Traffic[1]	
	2018 Daily Volume	2024 Daily Volume	2059 Daily Volume	2024 Daily Volume	2059 Daily Volume	2024	2059
SH 31 – West of FM 939	6,192	6,973	13,946	532	814	7.1%	5.5%
SH 31 – East of FM 939	6,069	6,835	13,669	176	272	2.5%	2.0%
FM 939 – North of SH 31	101	114	227	70	108	38.0%	32.2%
FM 939 – SH 31 to Site Drive	576	649	1,297	778	1,194	54.5%	47.9%
FM 939 – Site Drive to Happy Swaner Lane	576	649	1,297	106	164	14.0%	11.2%
FM 939 –Happy Swaner Lane to Kimbell Road	590	664	1,329	106	164	13.8%	11.0%
FM 939 – South of Kimbell Road	565	636	1,272	106	164	14.3%	11.4%
Happy Swaner Lane – West of FM 939	83	93	187	2	2	2.1%	1.1%
Kimbell Road – East of FM 939	25	28	56	2	2	6.7%	3.4%

[1] Total Daily Traffic = Background Traffic + Site Traffic

Intersection Capacity Analysis

Intersection capacity analysis was conducted using the 2059 background and total traffic volumes. If an intersection operates acceptably under the 2059 volumes, then it is reasonable to conclude that the intersections should also perform acceptably under the existing 2018 and 2024 volumes absent any changes in the proposed lane configuration or intersection control.

Intersection capacity analysis results for 2018 and 2024 (background and total) traffic conditions are included in the Appendix for reference.

The *Highway Capacity Manual* defines levels of service for automobiles at intersections based on the amount of average delay, in seconds/vehicle, experienced at the intersection. The Level of Service (LOS) of an intersection is a qualitative measure of the capacity and operating conditions and is directly related to vehicle delay.

For unsignalized intersections, the levels of service, as shown in **Table 10**, are defined by average control delay in seconds per vehicle. LOS is given a letter designation from A to F, with LOS A representing shorter delays and LOS F representing longer delays.

Table 10: Level of Service Criteria for Unsignalized Intersections

Level-of-Service (LOS)	Average Control Delay (seconds/vehicle)
A	≤ 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.0

SOURCE: *Highway Capacity Manual 6th Edition,* Transportation Research Board, 2016.

Unsignalized two-way stop control analysis was performed for the existing intersections along FM 939 in the vicinity of the site as well as the proposed site access roadway intersection with FM 939. It should be noted that HCM methodology does not provide intersection-wide delay or level of service for intersections operating under two-way stop control.

Based on the existing 24-hour automated traffic counts (Figure 3), the 10:00 AM to 11:00 AM site peak hour is a relatively low volume period for background traffic as compared to the peak AM and PM periods. However, site traffic volumes are anticipated to be higher during the site peak hour, so this time period was also included in the analysis.

The peak hour factor (PHF) for site traffic at the existing facility were: 0.69 from 7:00 AM to 8:00 AM; 0.90 from 10:00 AM to 11:00 AM; and 0.90 from 3:00 PM to 4:00 PM. In order to perform a conservative analysis, the facility traffic PHFs were utilized in the capacity analysis for facility turning movements if the PHF was lower than the PHF from the existing collected traffic count data. Otherwise the existing PHF from the count data were used in the analysis.

Site Closure (2059) Background Traffic Conditions

Table 11 presents the results of the 2059 background capacity analysis for the study area intersections. The existing lane configurations shown in Figure 2 and the traffic volumes shown in Figure 5 were used for this analysis.

Table 11: Intersection Capacity Analyses Results – Site Closure (2059) Background Traffic

Westbound SH 31 at FM 939 (Unsignalized – TWSC[1])				
Peak Hour	EB	WB[2]	NB	SB
AM Peak	---	0.0 (A)[3]	17.4 (C)	11.9 (B)
Site Peak	---	0.0 (A)	10.9 (B)	12.3 (B)
PM Peak	---	0.0 (A)	12.8 (B)	12.6 (B)
Eastbound SH 31 at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB[2]	WB	NB	SB
AM Peak	0.0 (A)[1]	---	11.4 (B)	11.6 (B)
Site Peak	0.0 (A)	---	10.8 (B)	11.3 (B)
PM Peak	0.0 (A)	---	15.1 (C)	16.4 (C)
Happy Swaner Lane at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB	WB	NB Left	SB[2]
AM Peak	9.1 (A)[1]	---	7.4 (A)	0.0 (A)
Site Peak	8.8 (A)	---	7.5 (A)	0.0 (A)
PM Peak	8.9 (A)	---	7.4 (A)	0.0 (A)
Kimbell Road at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB	WB	NB[2]	SB Left
AM Peak	---	9.3 (A)[1]	0.0 (A)	7.4 (A)
Site Peak	---	0.0 (A)	0.0 (A)	7.6 (A)
PM Peak	---	0.0 (A)	0.0 (A)	7.4 (A)

Note: 1 – Two-Way Stop-Control (TWSC)
2 – In the unsignalized intersection analyses, the eastbound and westbound through traffic movements on SH 31 will experience no delay at FM 939 and are predicted to operate at levels of service "A" in all analysis years. Similarly, the southbound and northbound movements on FM 939 at the stop controlled T-intersections will experience no delay with no left turning volumes.
3 - Delay in seconds/vehicle (Level of Service)

As can be seen in the table, the analysis indicates that the study intersections are predicted to operate in an acceptable fashion with the predicted 2059 background traffic volumes.

Site Closure (2059) Total Traffic Conditions

Table 12 presents the results of the 2059 total (background + site) capacity analysis for the study area intersections. The existing lane configurations and site driveway configuration shown in Figure 2 and the traffic volumes shown in Figure 10 were used for this analysis.

Table 12: Intersection Capacity Analyses Results – Site Closure (2059) Total Traffic

Westbound SH 31 at FM 939 (Unsignalized – TWSC[1])				
Peak Hour	EB	WB[2]	NB	SB
AM Peak	---	0.0 (A)[3]	25.0 (C)	15.6 (C)
Site Peak	---	0.0 (A)	14.7 (B)	15.8 (C)
PM Peak	---	0.0 (A)	16.5 (C)	13.5 (B)
Eastbound SH 31 at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB[2]	WB	NB	SB
AM Peak	0.0 (A)[1]	---	13.8 (B)	12.9 (B)
Site Peak	0.0 (A)	---	14.2 (B)	13.9 (B)
PM Peak	0.0 (A)	---	23.8 (C)	20.3 (C)
Happy Swaner Lane at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB	WB	NB Left	SB[2]
AM Peak	9.7 (A)[1]	---	7.5 (A)	0.0 (A)
Site Peak	9.5 (A)	---	7.9 (A)	0.0 (A)
PM Peak	9.2 (A)	---	7.6 (A)	0.0 (A)
Kimbell Road at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB	WB	NB[2]	SB Left
AM Peak	---	9.8 (A)[1]	0.0 (A)	7.5 (A)
Site Peak	---	9.0 (A)	0.0 (A)	8.0 (A)
PM Peak	---	9.6 (A)	0.0 (A)	7.5 (A)
Site Drive at FM 939 (Unsignalized – TWSC)				
Peak Hour	EB	WB	NB[2]	SB Left
AM Peak	---	10.8 (B)[1]	0.0 (A)	7.8 (A)
Site Peak	---	10.3 (B)	0.0 (A)	8.5 (A)
PM Peak	---	10.4 (B)	0.0 (A)	8.5 (A)

Note: 1 – Two-Way Stop-Control (TWSC)
2 – In the unsignalized intersection analyses, the eastbound and westbound through traffic movements on SH 31 will experience no delay at FM 939 and are predicted to operate at levels of service "A" in all analysis years. Similarly, the southbound and northbound movements on FM 939 at the stop controlled T-intersections will experience no delay with no left turning volumes.
3 - Delay in seconds/vehicle (Level of Service)

As shown, study intersections are anticipated to operate at acceptable levels of service with the addition of site traffic.

All study intersections are anticipated to operate acceptably for 2024 background and total traffic conditions as well, as shown in the Appendix.

Existing Gap Study Results

As part of this study, gap data was collected on SH 31 over a 24-hour period on Tuesday, October 30, 2018. All raw traffic data is included in the Appendix. Gap data was collected using automated machine counters on both the eastbound and westbound approaches to FM 939.

The critical headway, or gap, is the minimum time interval in the major roadway traffic stream that allows the entry of one minor road vehicle. The critical headway for minor street left turns onto the major roadway for two-way stop control analyses is computed using *Equation 20-30* from the *Highway Capacity Manual, 6th Edition*. The base critical headway from *Exhibit 20-12* in the *Highway Capacity Manual* varies by movement type and by the number of lanes on the major roadway. An excerpt from the *Highway Capacity Manual* with this equation and exhibit is attached to this addendum.

The configuration of SH 31 at the intersection with FM 939 is a four-lane divided roadway with deceleration lanes. As previously stated, the median is approximately 225 feet wide at FM 939, with two separate intersections (similar to a diamond interchange). Left-turns onto either westbound SH 31 or eastbound SH 31 from FM 939 require similar headways as the second stage of a two-stage left turn due to the one-way nature of the major street (SH 31) at each intersection. Similarly, the through movement on FM 939 across one direction of SH 31 would require a similar gap as the second stage of a two-stage through maneuver.

Table 13 presents the base critical headways from *Exhibit 20-12* of the *Highway Capacity Manual* for a four-lane roadway.

Table 13: Base Critical Headways (from Highway Capacity Manual 6th Edition, Exhibit 20-12)

Vehicle Movement	Four-Lane Roadway
Right turn from minor street	6.9
Through traffic on minor street	2 stage, Stage II: 5.5
Left turn from minor street	2 stage, Stage II: 6.5

The critical headways for each stage of the left turn from minor street maneuver were then calculated using the *Equation 20-30* from the *Highway Capacity Manual. Equation 20-30* and the inputs used in the computation are presented below:

Equation 20-30 = $t_{c,x} = t_{c,base} + t_{c,HV}P_{HV} + t_{c,G}G - t_{3,LT}$

$t_{c,x}$ = critical headway for left turn from minor roadway;

$t_{c,base}$ = values from Table 13 above;

$t_{c,HV}$ = 2.0 seconds for the heavy vehicle adjustment factor;

P_{HV} = 0.80 for a conservative assumption of 80% heavy vehicles on FM 939 at SH 31 with site traffic and existing heavy vehicles;

$t_{c,G}$ = adjustment factor for grade = 0.1 for minor street right turn, 0.2 for minor street through or left turn;

G = percent grade as an integer = assume 4 for conservative analysis (approximately level approaches observed on FM 939 at SH 31), and

$t_{3,LT}$ = 0.0 assuming a four-leg intersection.

These inputs result in the following computed critical headways:

Right turn from minor street = 8.9 seconds

Through traffic on minor street = 7.9 seconds

Left turn from minor street = 8.9 seconds

Based on the calculated critical headways, a gap of nine (9) seconds or more should allow for vehicles on FM 939 to enter or cross the traffic stream along either eastbound or westbound SH 31.

Individual vehicle headways were recorded and analyzed for the three analysis hours utilized in this study. These three study hours were the AM peak hour (7:00 AM to 8:00 AM), the facility peak hour (10:00 AM to 11:00 AM), and the PM peak hour (4:45 PM to 5:45 PM at the eastbound SH 31 intersection and 4:15 PM to 5:15 PM at the westbound SH 31 intersection).

Table 14, Table 15, and Table 16 present the gap data collected along each direction of SH 31 for each analysis hour. The breakdown and frequency of gaps in the eastbound and westbound traffic streams are presented.

Based on the gap data collected, the number and size of the available gaps appear suitable for the anticipated minor street volumes on FM 939 at the two stop-controlled intersections with SH 31. It should be noted that approximately one-third of the adequate gaps exceed 29 seconds in each analysis period. During onsite observations, some of these gaps are considerably longer than that, which would allow for multiple vehicles to perform their desired maneuver during the same gap.

Table 14: Gap Data for the AM Peak Hour

Gap Length (seconds)	Gap Frequency 7:00 AM – 8:00 AM	
	EB SH 31	WB SH 31
0-6	34	133
7-8	7	23
9-10	3	28
11-12	4	14
13-14	8	18
15-16	4	9
17-18	2	5
19-20	4	9
21+	62	55
Total Gaps 9seconds or longer	87	138

Table 15: Gap Data for the Facility Peak Hour

Gap Length (seconds)	Gap Frequency 10:00 AM – 11:00 AM	
	EB SH 31	WB SH 31
0-6	42	56
7-8	3	10
9-10	14	11
11-12	7	6
13-14	9	7
15-16	7	8
17-18	7	7
19-20	5	5
21+	61	68
Total Gaps 9 seconds or longer	110	112

Table 16: Gap Data for the PM Peak Hour

Gap Length (seconds)	Gap Frequency	
	4:45 PM – 5:45 PM	4:15 PM – 5:15 PM
	EB SH 31	WB SH 31
0-6	132	66
7-8	20	15
9-10	15	13
11-12	14	9
13-14	9	9
15-16	14	4
17-18	14	7
19-20	7	5
21+	59	52
Total Gaps 9 seconds or longer	132	99

Intersection Improvements SH 31 and FM 939

Based on the intersection capacity analyses presented previously, no improvements to the intersection of SH 31 and FM 939 are necessary to accommodate the projected background or projected site traffic. Based on a review of the projected traffic volumes, warrants for signalization of the intersections do not appear to be satisfied. TxDOT has indicated during a coordination meeting that the intersections would not be likely candidates for signalization. Given the increased traffic volumes anticipated at the intersection, Waco is planning to install yellow/red flashing beacons and intersection illumination at the FM 939 and SH 31 intersections.

AUXILIARY LANE ANALYSIS

Deceleration Lanes

Access to the proposed driveway will be provided via a proposed driveway connection to FM 939. This driveway will be newly constructed and will be approximately 2,048 feet south of SH 31.

Guidelines contained in TxDOT's *Access Management Manual* for roadways with a posted speed limit greater than 45 mph indicate that right turn deceleration lanes should be considered for right turn volumes greater than 50 vehicles per hour. Based on the estimated driveway volumes shown in Figure 9 and Figure 10, the northbound right turn volume into the site was 12 vehicles per hour. It is unlikely to exceed 50 right turns per hour during the life of the facility.

Based strictly on volume, the proposed site driveway does not warrant a deceleration lane at this time. However, right turn deceleration lanes may also be considered at locations where high truck volumes, heavy peak flow volumes, or other conditions exist where the safety and efficiency of the facility may be improved by the deceleration lane. Due to the high-speed nature of FM 939, Lee Engineering recommends that a right-turn deceleration lane be provided at the proposed site driveway.

Lee Engineering recommends that a right-turn deceleration lane with the following dimensions be provided on northbound FM 939 at the site entrance roadway:

- Total Length: 645 feet (includes taper and storage and 50' radius)
- Taper Length: 150 feet
- Storage Length: 30 feet
- Deceleration Length: 615 feet (includes taper)

It should be noted that the City of Waco has already determined that a southbound left turn lane on FM 939 at the site access roadway should be constructed. Lee Engineering concurs with this determination. Lee Engineering recommends that a left-turn deceleration lane with the following dimensions be provided on southbound FM 939 at the site entrance roadway:

- Total Length: 865 feet (includes taper and storage and 50' radius)
- Taper Length: 150 feet
- Storage Length: 250 feet
- Deceleration Length: 615 feet (includes taper)

Acceleration Lanes

Guidelines in TxDOT's *Access Management Manual* indicate that right turn acceleration lanes should be considered where right turn egress volumes exceed 200 vehicles per hour. The facility peak hour is predicted to generate 66 exiting vehicles during the 2059 facility peak. Due to the low volume nature of the exit movement along with the relatively low volumes on FM 939, Lee Engineering does not recommend a northbound acceleration lane be provided at the site.

Based on the turning volumes projected at SH 31, an acceleration lane is not necessary. Based on a coordination meeting with TxDOT, an acceleration lane serving northbound left-turns from FM 939 to westbound SH 31 would be acceptable along SH 31. Based on the TxDOT Roadway Design Manual criteria, an acceleration lane at this location would have a total length of 2,120 to 2,390 feet. The City of Waco should continue coordination with TxDOT to determine the likely lifespan of the acceleration lane improvements because the acceleration lane would not be a necessary improvement in the event that an overpass is constructed at the intersection of SH 31 and FM 939.

Intersection Sight Distance

As part of this traffic analysis, the required and available sight distances for motorists accessing the proposed site were evaluated. Guidelines for providing sight distance on roadways and intersections are provided by the American Association of State Highway and Transportation Officials (AASHTO) and published in the 2018 edition of *A Policy on Geometric Design of Highways and Streets*. Text from this document, discussing the minimum (stopping sight) and desirable (intersection) sight distances, is provided below:

> *Stopping sight distance is provided continuously along each roadway so that drivers have a view of the roadway ahead that is sufficient to allow drivers to stop. The provision of stopping sight distance at all locations along each roadway, including intersection approaches, is fundamental to intersection operation. (p. 9-35)*
>
> *If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, a major-road vehicle may need to slow or stop to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances that exceed stopping sight distances are desirable along the major road. (p.9-35)*

For the intersection of the site driveway and FM 939, the minimum required (based on stopping sight distance) and desirable (based on intersection sight distance) sight distances were estimated using procedures published in AASHTO's *A Policy on Geometric Design of Highways and Streets* (2018). The design vehicle used was a combination truck which has an initial time gap of 11.5 seconds. This time gap is suitable for left turn maneuvers from the site driveway directly into the southbound lane of FM 939. This time gap results in a calculated desirable intersection sight distance value of approximately 1,015 feet for the combination truck.

A passenger car has an initial time gap of 7.5 seconds. The calculated desirable intersection sight distance for a passenger car is approximately 665 feet.

In order to evaluate the adequacy of existing sight distances looking left and right from the proposed site driveway, the available intersection sight distances were determined by field measurement. Lee Engineering measured the lines of sight looking to the left and the right from the proposed sight driveway location. The observer was positioned at the approximate driver's eye location in the exit lane of the proposed site driveway. A target object with a height of 3.5 feet above the pavement was used to determine the maximum available sight distance looking left (to the south) and right (to the north) along FM 939.

Based on the field measurements, adequate sight distance is available at the proposed site driveway. The summary of the sight distance evaluation is presented in **Table 17**. The proposed location of the site driveway will provide adequate sight distance to the south and to the north for both combination trucks and passenger cars exiting the site.

Table 17: Analysis of Intersection Sight Distance

Major Roadway	FM 939	
Posted Speed Limit	60 mph	
Minor Roadway	Site Drive	
Design Vehicle	Passenger Car	Combination Truck WB 67
Driver’s Eye (Observation) Height	3.5’	7.6’
Target Object Height	3.5’	3.5’
MINIMUM Sight Distance (Stopping)	570’	570’
DESIRABLE Sight Distance (Intersection)	665’	1,015’
Available Sight Distance to the Left	1,314’	
Available Sight Distance to the Right	2,223’	
Sight Distance Available > MINIMUM		
To the Left	YES	YES
To the Right	YES	YES
Sight Distance Available > DESIRABLE		
To the Left	YES	YES
To the Right	YES	YES

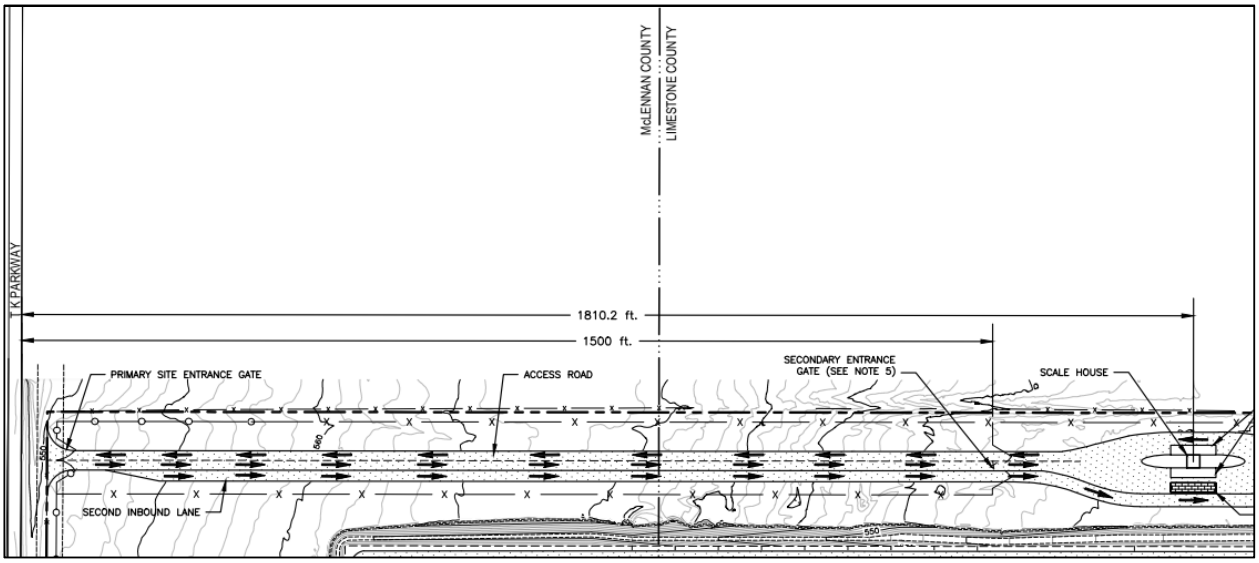
FACILITY QUEUE STORAGE

Based on the Facility Entrance Plan dated August 2019, the scale house is separated from FM 939 by approximately 1,800 feet. The current entrance plan will provide two inbound queue lanes, providing approximately 3,300 feet of queue storage from the scales back to FM 939. According to representatives of the City of Waco, 40 to 50 vehicle queues have been observed at the existing landfill site on occasion. These queues are typically passenger vehicle (pickup trucks) with utility trailers. At an assumed vehicle length of 50’, queue storage for approximately 2,000 to 2,500 feet would be necessary. The proposed facility entrance plan has over 3,300 feet of queue storage, 65 percent more than an estimated queue length of 2,000 feet and 32 percent more than an estimated queue length of 2,500 feet.

The facility entrance will have a primary site entrance gate located near FM 939 and a secondary entrance gate located approximately 1500 feet from the primary gate. The primary gate will be opened at 5:30 AM to allow for vehicle queue storage prior to opening the site for waste acceptance. There is more than 2,500 feet of combined queue storage available in the two lanes between the primary and secondary gate. In the unlikely event that the site experiences a queue that reaches FM 939, additional queue storage is available in the left and right turn lanes along FM 939.

The facility entrance plan is shown in Figure 11 and provides adequate queue storage. The full drawing is included in the appendix.

Figure 11.Queue Storage: Facility Entrance Plan Excerpt



CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study for the City of Waco MSW Facility, the following conclusions are made:

- The proposed site is predicted to generate 884 trips per day when the facility is anticipated to open in 2024, including employee trips. 1,358 trips per day are predicted during year 2059 operations when the site is anticipated to reach its design life.

- Roadway link capacity analyses for the year 2024 and 2059 for the surrounding roadways indicate that adequate capacity will be available to serve the additional traffic generated by the future operations of the proposed MSW Facility along with assumed background growth.

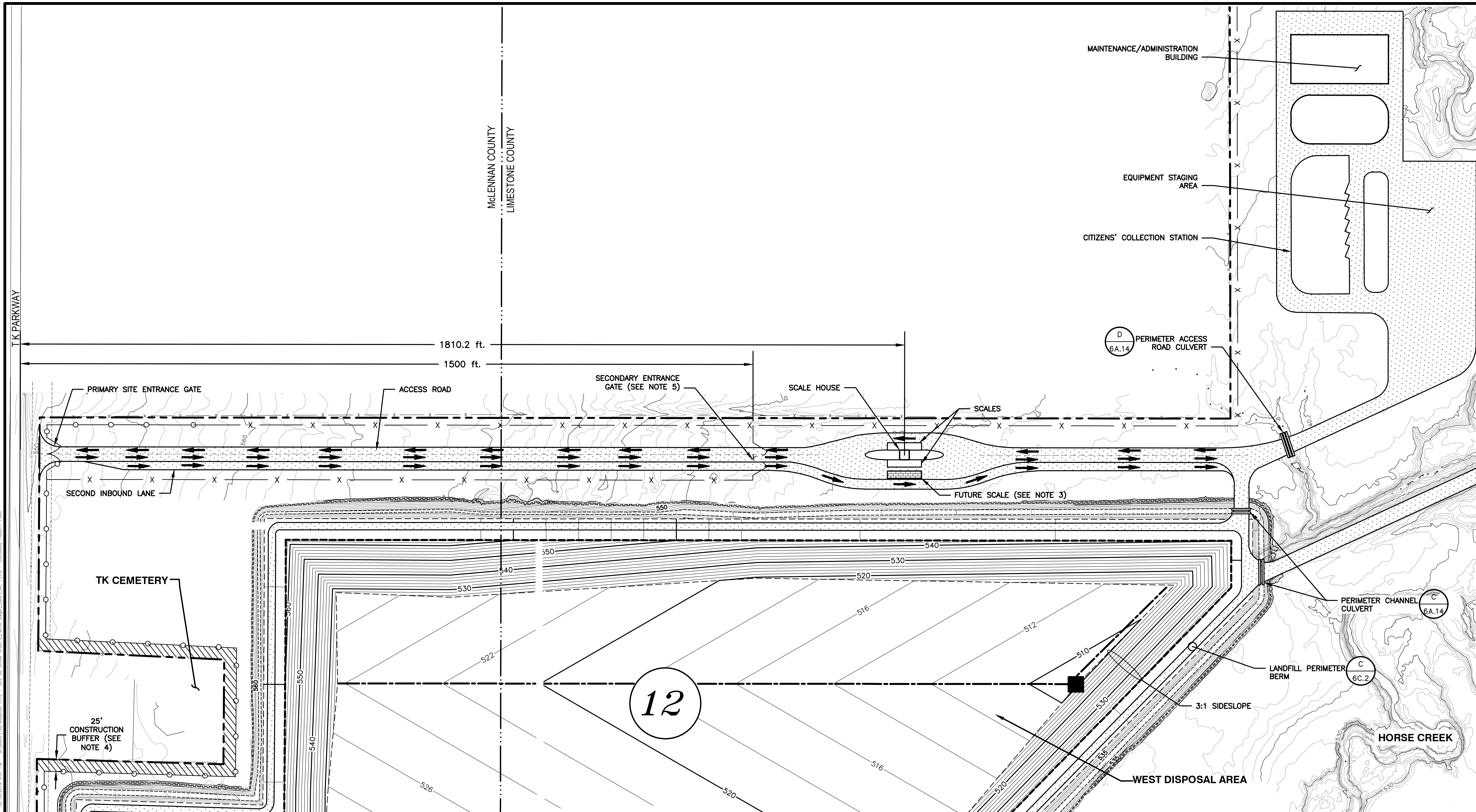
- Intersection capacity analysis indicates that the study intersections are anticipated to operate at acceptable levels of service for predicted background and total traffic operations in 2024 and 2059.

- The City of Waco is planning to improve the section of FM 939 between SH 31 and the facility entrance. These improvements include the following:
    1. A structural overlay on the two-lane road (to the extent required after future TxDOT improvements along FM 939 are in place);
    2. Adding eight-foot shoulders on both sides of the road;
    3. Adding a southbound left-turn lane for vehicles entering the facility access; and
    4. Adding a northbound right-turn lane for vehicles entering the facility access.

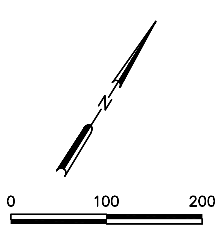
- The City of Waco is planning to construct a westbound acceleration lane and yellow/red flashing beacons and intersection illumination on SH 31 despite the relatively low predicted left-turn volumes
    1. Lee Engineering recommends that the City coordinate with TxDOT such that the acceleration lane is only constructed if it will have a suitable lifespan. The need for the acceleration lane is eliminated if an overpass is constructed at the intersection of SH 31 and FM 939

- No additional changes to the surrounding roadway network are recommended to accommodate the site traffic generated by the predicted operations of the City of Waco MSW Facility.

APPENDIX



LEGEND



- PERMIT BOUNDARY
- LIMITS OF WASTE
- COUNTY LINE
- EXISTING TOPOGRAPHIC CONTOURS (SEE NOTE 1)
- PROPOSED PERIMETER FENCE
- PROPOSED 8' PRIVACY FENCE
- ACCESS ROAD
- EXCAVATION GRADE TOPOGRAPHIC CONTOURS (SEE NOTE 2)
- LEACHATE COLLECTION TRENCH
- TOE/TOP OF SLOPE
- TRAFFIC FLOW ARROW

NOTES:

1. THE EXISTING TOPOGRAPHY SHOWN ON THIS PLAN WAS DEVELOPED BY DAS GEOSPATIAL FLOWN ON JULY 03, 2018.
2. ELEVATIONS SHOWN ON THIS DRAWING WITHIN WASTE LIMITS ARE EXCAVATION GRADES (BOTTOM OF LINER) ELEVATIONS IN FEET MEAN SEA LEVEL (FT MSL).
3. FUTURE INBOUND SCALE WILL BE INSTALLED AS NEEDED TO ACCOMMODATE INCREASES IN THE WASTE ACCEPTANCE RATE OVER THE SITE OPERATING LIFE.
4. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018 (SEE APPENDIX I/IIA), A 25-FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.
5. THE PRIMARY ENTRANCE GATE WILL BE OPENED AT 5:30 AM ON DAYS THE SITE IS IN OPERATION TO ALLOW VEHICLE QUEUING PRIOR TO OPENING THE SITE FOR WASTE ACCEPTANCE.

Revision 3

October 2020

FOR PERMITTING PURPOSES ONLY

REV | DATE | DESCRIPTION | BY

TEXAS BOARD OF PROFESSIONAL ENGINEERS REG. NO. F-3407

DRAWING TITLE: **ENTRANCE FACILITY PLAN**

PROJECT TITLE: **CITY OF WACO LANDFILL TYPE I MSW - PERMIT APPLICATION**

CLIENT: **CITY OF WACO PUBLIC WORKS DEPARTMENT 401 FRANKLIN AVENUE WACO, TX 76701**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
1901 CENTRAL DRIVE, SUITE 550, BEDFORD, TX 76021
PH (817) 571-2288 FAX NO. (817) 571-2188

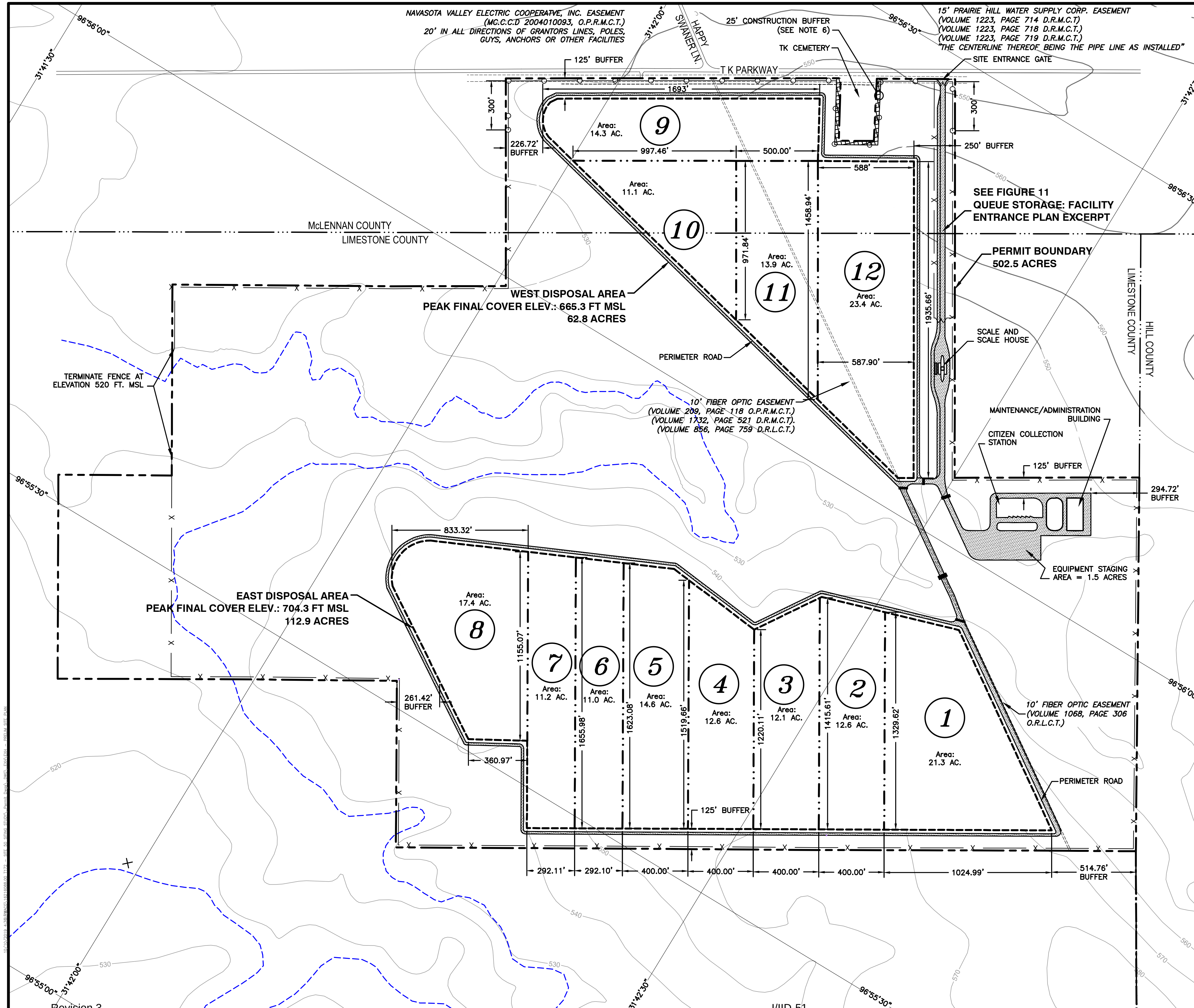
PROJ. NO. 16216088.00 | DSN. BY: BC/RRK | DWN. BY: NR | CHK. BY: BJD | Q/A RVW BY: RRK | APP. BY: RRK

CADD FILE: 1.5 – ENTRANCE FACILITY PLAN

DATE: 08/2019

SCALE: AS SHOWN

DRAWING NO. **1.5**



LEGEND

- EXISTING TOPOGRAPHIC CONTOURS (SEE NOTE 1)
- PERMIT BOUNDARY
- LIMITS OF WASTE
- SECTOR BOUNDARY
- COUNTY LINE
- 100-YEAR FLOOD PLAIN (SEE NOTE 2)
- LATITUDE/LONGITUDE LINES
- PERIMETER FENCE
- 8' PRIVACY FENCE
- ACCESS ROAD
- SECTOR DESIGNATION (SEE NOTE 5)

NOTES:

1. CONTOURS SHOWN ARE FROM THE 24K QUAD MAP FOR AXTELL, TEXAS (2016) PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY.
2. 100-YEAR FLOOD PLAIN IS DESIGNATED AS ZONE A, BASED ON FIRM PANEL 48293C0125C, DATED 09/16/11.
3. FIBER OPTIC LINE EASEMENT, VOLUME 209, PAGE 118 MCLENNAN CO. RECORDS, IF EXISTING AT TIME OF LANDFILL DEVELOPMENT, WILL BE RELOCATED PRIOR TO CONSTRUCTION OF SECTORS 9 THROUGH 13 AND WILL BE VACATED. IF FIBER LINE IS NOT INSTALLED WITHIN EASEMENT, THEN EASEMENT IS ABANDONED ON ITS OWN TERMS.
4. A FLOWAGE EASEMENT EXISTS ON THE PROPERTY THAT IS UNDER THE JURISDICTION OF THE TECHUACANA CREEK WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER (1) OF LEROY, TEXAS SUBJECT TO THE EASEMENT RECORDED IN VOLUME 498, PAGE 118, VOLUME 506, PAGE 181, VOLUME 507, PAGE 378, AND VOLUME 509, PAGE 417 OF THE DEED RECORDS OF LIMESTONE COUNTY, TEXAS.
5. SECTOR DEVELOPMENT SEQUENCE REPRESENTED BY SECTOR NUMBER, MAY BE DEVELOPED IN SMALLER INCREMENTS (AKA SUBSECTORS OR CELLS) WITH LINER CERTIFICATIONS SUBMITTED SEPARATELY TO TCEQ.
6. IN ACCORDANCE WITH "AN INTENSIVE CULTURAL RESOURCES SURVEY OF THE CITY OF WACO'S PROPOSED SITE 50 LANDFILL PROJECT," PREPARED BY HORIZON ENVIRONMENTAL SERVICES, INC., DATED NOVEMBER 2018, A 25-FOOT CONSTRUCTION BUFFER WILL BE MAINTAINED AROUND TK CEMETERY TO PROTECT ANY POTENTIAL UNMARKED GRAVES OUTSIDE THE PRESENT MODERN DAY CEMETERY BOUNDARIES AND FENCING.

October2020

EXHIBIT I: PRELIMINARY SITE PLAN FOR INFORMATION PURPOSES ONLY

SCS ENGINEERS

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: EB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018
Page No: 1

Turning Movement Data

Start Time	FM 939 Southbound					Westbound St. Westbound					FM 939 Northbound					SH 31 EB Eastbound					
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
12:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	9	10
12:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7	7
12:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8	8
12:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
Hourly Total	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	27	0	0	27	28
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
1:15 AM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	1	0	4	6
1:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
1:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	5
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	12	1	0	13	16
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	5
2:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	6	6
2:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	0	0	2	4
2:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	8	0	0	8	9
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	20	1	0	21	24
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3:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
3:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
3:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10	10
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4:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	8	0	0	9	11
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5:15 AM	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	0	8	0	0	8	16
5:30 AM	0	2	0	0	2	0	0	0	0	0	0	2	1	0	3	0	17	2	0	19	24
5:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	12	0	0	12	13
Hourly Total	0	7	0	0	7	0	0	0	0	0	0	6	2	0	8	0	42	2	0	44	59
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6:30 AM	0	2	0	0	2	0	0	0	0	0	0	4	2	0	6	0	20	2	0	22	30
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7:30 AM	0	8	0	0	8	0	0	0	0	0	0	6	5	0	11	2	28	5	0	35	54
7:45 AM	0	2	0	0	2	0	0	0	0	0	0	8	4	0	12	0	34	1	0	35	49
Hourly Total	0	15	0	0	15	0	0	0	0	0	0	26	18	0	44	2	132	10	0	144	203
8:00 AM	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	0	31	3	0	34	38
8:15 AM	0	1	0	0	1	0	0	0	0	0	0	2	1	0	3	0	34	2	0	36	40
8:30 AM	0	4	0	0	4	0	0	0	0	0	0	1	1	0	2	0	28	1	0	29	35
8:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	2	0	3	1	26	1	0	28	32
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9:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	47	0	0	48	50
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10:30 AM	1	1	0	0	2	0	0	0	0	0	0	2	0	0	2	1	30	1	0	32	36
10:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	33	0	0	33	34
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11:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	38	2	0	40	43
11:45 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	45	1	0	46	48
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12:15 PM	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	0	41	1			48
12:30 PM	0	1	0	0	1	0	0	0	0	0	0	2	3	0	5	0	50	3	0	53	59

0 42

12:45 PM	1	1	0	0	2	0	0	0	0	0	0	1	3	0	4	0	37	1	0	38	44
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3:30 PM	1	2	0	0	3	0	0	0	0	0	0	4	2	0	6	0	61	3	0	64	73
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5:30 PM	0	5	0	0	5	0	0	0	0	0	0	3	1	0	4	0	80	7	0	87	96
5:45 PM	0	2	0	0	2	0	0	0	0	0	0	2	2	0	4	1	65	7	0	73	79
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6:15 PM	0	3	0	0	3	0	0	0	0	0	0	3	1	0	4	4	59	3	0	66	73
6:30 PM	0	0	0	0	0	0	0	0	0	0	0	7	2	0	9	0	41	5	0	46	55
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7:15 PM	0	0	0	0	0	0	0	0	0	0	0	2	1	0	3	0	35	1	0	36	39
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9:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	14	3	0	17	18
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	17	0	0	17	18
Hourly Total	0	2	0	0	2	0	0	0	0	0	0	1	2	0	3	0	81	8	0	89	94
10:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	20	1	0	21	22
10:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	14	1	0	15	17
10:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	9	1	0	10	11
10:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	14	0	0	14	16
Hourly Total	0	1	0	0	1	0	0	0	0	0	0	2	3	0	5	0	57	3	0	60	66
11:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	12	0	0	12	14
11:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	18	18
11:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	10	0	0	10	11
11:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	9	10
Hourly Total	0	1	0	0	1	0	0	0	0	0	0	2	1	0	3	0	49	0	0	49	53
Grand Total	6	133	0	0	139	0	0	0	0	0	0	173	113	0	286	30	2882	157	0	3069	3494
Approach %	4.3	95.7	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	60.5	39.5	0.0	-	1.0	93.9	5.1	0.0	-	-
Total %	0.2	3.8	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	3.2	0.0	8.2	0.9	82.5	4.5	0.0	87.8	-
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	9	9
% Motorcycles	0.0	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	0.3	0.0	-	0.3	0.3
Cars & Light Goods	6	124	0	0	130	0	0	0	0	0	0	159	111	0	270	28	2417	151	0	2596	2996
% Cars & Light Goods	100.0	93.2	-	-	93.5	-	-	-	-	-	-	91.9	98.2	-	94.4	93.3	83.9	96.2	-	84.6	85.7
Buses	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	7	1	0	9	10
% Buses	0.0	0.0	-	-	0.0	-	-	-	-	-	-	0.6	0.0	-	0.3	3.3	0.2	0.6	-	0.3	0.3
Single-Unit Trucks	0	4	0	0	4	0	0	0	0	0	0	13	0	0	13	1	101	3	0	105	122
% Single-Unit Trucks	0.0	3.0	-	-	2.9	-	-	-	-	-	-	7.5	0.0	-	4.5	3.3	3.5	1.9	-	3.4	3.5
Articulated Trucks	0	5	0	0	5	0	0	0	0	0	0	0	2	0	2	0	348	2	0	350	357
% Articulated Trucks	0.0	3.8	-	-	3.6	-	-	-	-	-	-	0.0	1.8	-	0.7	0.0	12.1	1.3	-	11.4	10.2

GRAM Traffic NTX Inc.
1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: EB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018

Turning Movement Peak Hour Data (7:00 AM)

Start Time	FM 939 Southbound					Westbound St. Westbound					FM 939 Northbound					SH 31 EB Eastbound					
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
7:00 AM	0	3	0	0	3	0	0	0	0	0	0	8	3	0	11	0	32	1	0	33	47
7:15 AM	0	2	0	0	2	0	0	0	0	0	0	4	6	0	10	0	38	3	0	41	53
7:30 AM	0	8	0	0	8	0	0	0	0	0	0	6	5	0	11	2	28	5	0	35	54
7:45 AM	0	2	0	0	2	0	0	0	0	0	0	8	4	0	12	0	34	1	0	35	49
Total	0	15	0	0	15	0	0	0	0	0	0	26	18	0	44	2	132	10	0	144	203
Approach %	0.0	100.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	59.1	40.9	0.0	-	1.4	91.7	6.9	0.0	-	-
Total %	0.0	7.4	0.0	0.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	12.8	8.9	0.0	21.7	1.0	65.0	4.9	0.0	70.9	-
PHF	0.000	0.469	0.000	0.000	0.469	0.000	0.000	0.000	0.000	0.000	0.000	0.813	0.750	0.000	0.917	0.250	0.868	0.500	0.000	0.878	0.940
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Cars & Light Goods	0	14	0	0	14	0	0	0	0	0	0	26	18	0	44	2	109	10	0	121	179
% Cars & Light Goods	-	93.3	-	-	93.3	-	-	-	-	-	-	100.0	100.0	-	100.0	100.0	82.6	100.0	-	84.0	88.2
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	9	9
% Single-Unit Trucks	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	6.8	0.0	-	6.3	4.4
Articulated Trucks	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14	15
% Articulated Trucks	-	6.7	-	-	6.7	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	10.6	0.0	-	9.7	7.4

GRAM Traffic NTX Inc.
1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: EB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018

Turning Movement Peak Hour Data (4:45 PM)

Start Time	FM 939 Southbound Left	Thru	Right	U-Turn	App. Total	Westbound St. Westbound Left	Thru	Right	U-Turn	App. Total	FM 939 Northbound Left	Thru	Right	U-Turn	App. Total	SH 31 EB Eastbound Left	Thru	Right	U-Turn	App. Total	Int. Total
4:45 PM	0	5	0	0	5	0	0	0	0	0	0	4	2	0	6	0	76	2	0	78	89
5:00 PM	0	1	0	0	1	0	0	0	0	0	0	7	2	0	9	1	59	6	0	66	76
5:15 PM	0	3	0	0	3	0	0	0	0	0	0	2	5	0	7	0	69	7	0	76	86
5:30 PM	0	5	0	0	5	0	0	0	0	0	0	3	1	0	4	0	80	7	0	87	96
Total	0	14	0	0	14	0	0	0	0	0	0	16	10	0	26	1	284	22	0	307	347
Approach %	0.0	100.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	61.5	38.5	0.0	-	0.3	92.5	7.2	0.0	-	-
Total %	0.0	4.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	2.9	0.0	7.5	0.3	81.8	6.3	0.0	88.5	-
PHF	0.000	0.700	0.000	0.000	0.700	0.000	0.000	0.000	0.000	0.000	0.000	0.571	0.500	0.000	0.722	0.250	0.888	0.786	0.000	0.882	0.904
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Motorcycles	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	0.4	0.0	-	0.3	0.3
Cars & Light Goods	0	14	0	0	14	0	0	0	0	0	0	15	10	0	25	1	266	21	0	288	327
% Cars & Light Goods	-	100.0	-	-	100.0	-	-	-	-	-	-	93.8	100.0	-	96.2	100.0	93.7	95.5	-	93.8	94.2
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% Buses	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	0.0	4.5	-	0.3	0.3
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	5	0	0	5	6
% Single-Unit Trucks	-	0.0	-	-	0.0	-	-	-	-	-	-	6.3	0.0	-	3.8	0.0	1.8	0.0	-	1.6	1.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	12	12
% Articulated Trucks	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	-	0.0	0.0	4.2	0.0	-	3.9	3.5

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: WB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018
Page No: 1

Turning Movement Data

Start Time	FM 939 Southbound					SH 31 WB Westbound					FM 939 Northbound					Eastbound St. Eastbound					
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
12:00 AM	0	0	0	0	0	1	3	0	0	4	1	0	0	0	1	0	0	0	0	0	5
12:15 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
12:30 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
12:45 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
Hourly Total	0	0	0	0	0	1	14	0	0	15	1	0	0	0	1	0	0	0	0	0	16
1:00 AM	0	0	0	0	0	1	6	0	0	7	0	0	0	0	0	0	0	0	0	0	7
1:15 AM	0	0	0	0	0	2	5	0	0	7	0	0	0	0	0	0	0	0	0	0	7
1:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 AM	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	3
Hourly Total	0	0	0	0	0	4	13	0	0	17	0	0	0	0	0	0	0	0	0	0	17
2:00 AM	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	0	0	0	0	7
2:15 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
2:30 AM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
2:45 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
Hourly Total	0	0	0	0	0	0	17	0	0	17	0	0	0	0	0	0	0	0	0	0	17
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 AM	0	0	0	0	0	0	4	1	0	5	0	0	0	0	0	0	0	0	0	0	5
3:30 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
3:45 AM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
Hourly Total	0	0	0	0	0	0	12	1	0	13	0	0	0	0	0	0	0	0	0	0	13
4:00 AM	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	6
4:15 AM	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	0	0	0	0	8
4:30 AM	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	0	0	0	0	0	11
4:45 AM	0	0	0	0	0	1	10	0	0	11	0	1	0	0	1	0	0	0	0	0	12
Hourly Total	0	0	0	0	0	1	35	0	0	36	0	1	0	0	1	0	0	0	0	0	37
5:00 AM	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	0	0	0	0	0	15
5:15 AM	0	0	0	0	0	4	21	0	0	25	3	0	0	0	3	0	0	0	0	0	28
5:30 AM	0	0	0	0	0	2	33	0	0	35	1	0	0	0	1	0	0	0	0	0	36
5:45 AM	0	0	1	0	1	1	22	0	0	23	2	0	0	0	2	0	0	0	0	0	26
Hourly Total	0	0	1	0	1	7	91	0	0	98	6	0	0	0	6	0	0	0	0	0	105
6:00 AM	0	0	2	0	2	2	44	0	0	46	1	0	0	0	1	0	0	0	0	0	49
6:15 AM	0	0	1	0	1	0	44	0	0	44	4	0	0	0	4	0	0	0	0	0	49
6:30 AM	0	0	0	0	0	1	37	0	0	38	3	0	0	0	3	0	0	0	0	0	41
6:45 AM	0	1	0	0	1	3	52	0	0	55	6	0	0	0	6	0	0	0	0	0	62
Hourly Total	0	1	3	0	4	6	177	0	0	183	14	0	0	0	14	0	0	0	0	0	201
7:00 AM	0	0	2	0	2	4	52	0	0	56	6	0	0	0	6	0	0	0	0	0	64
7:15 AM	0	0	4	0	4	2	86	0	0	88	6	0	0	0	6	0	0	0	0	0	98
7:30 AM	0	0	2	0	2	8	95	0	0	103	5	2	0	0	7	0	0	0	0	0	112
7:45 AM	0	0	0	0	0	2	56	0	0	58	8	1	0	0	9	0	0	0	0	0	67
Hourly Total	0	0	8	0	8	16	289	0	0	305	25	3	0	0	28	0	0	0	0	0	341
8:00 AM	0	0	1	0	1	3	55	0	0	58	1	0	0	0	1	0	0	0	0	0	60
8:15 AM	0	0	1	0	1	1	49	0	0	50	2	0	0	0	2	0	0	0	0	0	53
8:30 AM	0	0	0	0	0	4	48	0	0	52	1	0	0	0	1	0	0	0	0	0	53
8:45 AM	0	0	0	0	0	1	48	0	0	49	0	2	0	0	2	0	0	0	0	0	51
Hourly Total	0	0	2	0	2	9	200	0	0	209	4	2	0	0	6	0	0	0	0	0	217
9:00 AM	0	0	0	0	0	0	39	0	0	39	2	3	0	0	5	0	0	0	0	0	44
9:15 AM	0	0	0	0	0	2	59	1	0	62	4	1	0	0	5	0	0	0	0	0	67
9:30 AM	0	0	1	0	1	1	60	0	0	61	0	0	0	0	0	0	0	0	0	0	62
9:45 AM	0	1	0	0	1	1	57	0	0	58	0	1	0	0	1	0	0	0	0	0	60
Hourly Total	0	1	1	0	2	4	215	1	0	220	6	5	0	0	11	0	0	0	0	0	233
10:00 AM	0	0	0	0	0	2	37	0	0	39	2	1	0	0	3	0	0	0	0	0	42
10:15 AM	0	0	0	0	0	1	48	0	0	49	1	0	0	0	1	0	0	0	0	0	50
10:30 AM	0	2	0	0	2	0	36	0	0	36	3	1	0	0	4	0	0	0	0	0	42
10:45 AM	0	0	0	0	0	1	44	0	0	45	1	0	0	0	1	0	0	0	0	0	46
Hourly Total	0	2	0	0	2	4	165	0	0	169	7	2	0	0	9	0	0	0	0	0	180
11:00 AM	0	0	0	0	0	0	35	0	0	35	2	0	0	0	2	0	0	0	0	0	37
11:15 AM	0	0	1	0	1	0	60	0	0	60	2	0	0	0	2	0	0	0	0	0	63
11:30 AM	0	0	0	0	0	0	41	0	0	41	2	0	0	0	2	0	0	0	0	0	43
11:45 AM	0	0	0	0	0	1	37	0	0	38	1	0	0	0	1	0	0	0	0	0	39
Hourly Total	0	0	1	0	1	1	173	0	0	174	7	0	0	0	7	0	0	0	0	0	182
12:00 PM	0	0	1	0	1	1	49	0	0	50	1	0	0	0	1	0	0	0	0	0	52
12:15 PM	0	0	0	0	0	3	40	0	0	43	2	0	0	0	2	0	0	0	0	0	45
12:30 PM	0	0	0	0	0	1	44	0	0	45	3	0	0	0	3	0	0	0	0	0	48

12:45 PM	0	1	0	0	1	1	37	0	0	38	0	0	0	0	0	0	0	0	0	0	39
Hourly Total	0	1	1	0	2	6	170	0	0	176	6	0	0	0	6	0	0	0	0	0	184
1:00 PM	0	0	0	0	0	3	41	0	0	44	5	0	0	0	5	0	0	0	0	0	49
1:15 PM	0	0	1	0	1	4	44	0	0	48	3	1	0	0	4	0	0	0	0	0	53
1:30 PM	0	0	1	0	1	0	52	1	0	53	1	0	0	0	1	0	0	0	0	0	55
1:45 PM	0	0	0	0	0	1	39	0	0	40	4	3	0	0	7	0	0	0	0	0	47
Hourly Total	0	0	2	0	2	8	176	1	0	185	13	4	0	0	17	0	0	0	0	0	204
2:00 PM	0	0	0	0	0	3	40	0	0	43	3	1	0	0	4	0	0	0	0	0	47
2:15 PM	0	3	0	0	3	2	56	0	0	58	2	0	0	0	2	0	0	0	0	0	63
2:30 PM	0	0	0	0	0	3	45	0	0	48	3	1	0	0	4	0	0	0	0	0	52
2:45 PM	0	1	1	0	2	4	48	0	0	52	4	1	0	0	5	0	0	0	0	0	59
Hourly Total	0	4	1	0	5	12	189	0	0	201	12	3	0	0	15	0	0	0	0	0	221
3:00 PM	0	0	0	0	0	0	47	0	0	47	1	2	0	0	3	0	0	0	0	0	50
3:15 PM	0	0	0	0	0	2	34	0	0	36	2	2	0	0	4	0	0	0	0	0	40
3:30 PM	0	0	0	0	0	1	40	0	0	41	5	0	0	0	5	0	0	0	0	0	46
3:45 PM	0	4	0	0	4	1	46	0	0	47	1	1	0	0	2	0	0	0	0	0	53
Hourly Total	0	4	0	0	4	4	167	0	0	171	9	5	0	0	14	0	0	0	0	0	189
4:00 PM	0	1	0	0	1	3	54	0	0	57	4	0	0	0	4	0	0	0	0	0	62
4:15 PM	0	0	0	0	0	2	52	0	0	54	4	2	0	0	6	0	0	0	0	0	60
4:30 PM	0	4	0	0	4	2	45	0	0	47	0	0	0	0	0	0	0	0	0	0	51
4:45 PM	0	0	1	0	1	5	58	0	0	63	2	2	0	0	4	0	0	0	0	0	68
Hourly Total	0	5	1	0	6	12	209	0	0	221	10	4	0	0	14	0	0	0	0	0	241
5:00 PM	0	0	2	0	2	1	55	0	0	56	6	2	0	0	8	0	0	0	0	0	66
5:15 PM	0	0	0	0	0	3	44	0	0	47	2	0	0	0	2	0	0	0	0	0	49
5:30 PM	0	0	0	0	0	5	34	1	0	40	3	0	0	1	4	0	0	0	0	0	44
5:45 PM	0	0	0	0	0	2	52	0	0	54	2	1	0	0	3	0	0	0	0	0	57
Hourly Total	0	0	2	0	2	11	185	1	0	197	13	3	0	1	17	0	0	0	0	0	216
6:00 PM	0	1	0	0	1	3	34	1	0	38	1	0	0	2	3	0	0	0	1	1	43
6:15 PM	0	1	0	0	1	2	32	0	0	34	4	3	0	0	7	0	0	0	0	0	42
6:30 PM	0	0	0	0	0	0	36	0	0	36	4	2	0	1	7	0	0	0	0	0	43
6:45 PM	0	1	0	0	1	2	34	0	0	36	1	1	0	0	2	0	0	0	0	0	39
Hourly Total	0	3	0	0	3	7	136	1	0	144	10	6	0	3	19	0	0	0	1	1	167
7:00 PM	0	0	0	0	0	0	30	0	0	30	2	2	0	0	4	0	0	0	0	0	34
7:15 PM	0	0	0	0	0	0	25	0	0	25	2	0	0	0	2	0	0	0	0	0	27
7:30 PM	0	0	0	0	0	0	30	0	0	30	2	2	0	0	4	0	0	0	0	0	34
7:45 PM	0	1	1	0	2	1	30	0	0	31	0	1	0	0	1	0	0	0	0	0	34
Hourly Total	0	1	1	0	2	1	115	0	0	116	6	5	0	0	11	0	0	0	0	0	129
8:00 PM	0	0	0	0	0	0	21	0	0	21	0	0	0	0	0	0	0	0	0	0	21
8:15 PM	0	0	0	0	0	1	12	1	0	14	0	0	0	0	0	0	0	0	0	0	14
8:30 PM	0	0	1	0	1	2	17	0	0	19	2	0	0	0	2	0	0	0	0	0	22
8:45 PM	0	0	0	0	0	0	14	0	0	14	1	1	0	0	2	0	0	0	0	0	16
Hourly Total	0	0	1	0	1	3	64	1	0	68	3	1	0	0	4	0	0	0	0	0	73
9:00 PM	0	0	0	0	0	0	19	0	0	19	0	0	0	0	0	0	0	0	0	0	19
9:15 PM	0	0	0	0	0	1	13	0	0	14	0	0	0	0	0	0	0	0	0	0	14
9:30 PM	0	0	0	0	0	1	24	0	0	25	1	0	0	0	1	0	0	0	0	0	26
9:45 PM	0	0	1	0	1	0	13	0	0	13	0	0	0	0	0	0	0	0	0	0	14
Hourly Total	0	0	1	0	1	2	69	0	0	71	1	0	0	0	1	0	0	0	0	0	73
10:00 PM	0	0	0	0	0	0	18	0	0	18	0	1	0	0	1	0	0	0	0	0	19
10:15 PM	0	0	0	0	0	0	9	0	0	9	0	2	0	0	2	0	0	0	0	0	11
10:30 PM	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	6
10:45 PM	0	0	0	0	0	1	16	0	0	17	0	0	0	0	0	0	0	0	0	0	17
Hourly Total	0	0	0	0	0	1	49	0	0	50	0	3	0	0	3	0	0	0	0	0	53
11:00 PM	0	0	0	0	0	0	1	0	0	1	2	0	0	0	2	0	0	0	0	0	3
11:15 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
11:30 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	4
11:45 PM	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	3
Hourly Total	0	0	0	0	0	1	11	0	0	12	2	0	0	0	2	0	0	0	0	0	14
Grand Total	0	22	26	0	48	121	2941	6	0	3068	155	47	0	4	206	0	0	0	1	1	3323
Approach %	0.0	45.8	54.2	0.0	-	3.9	95.9	0.2	0.0	-	75.2	22.8	0.0	1.9	-	0.0	0.0	0.0	100.0	-	-
Total %	0.0	0.7	0.8	0.0	1.4	3.6	88.5	0.2	0.0	92.3	4.7	1.4	0.0	0.1	6.2	0.0	0.0	0.0	0.0	0.0	-
Motorcycles	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	0	0	0	0	0	15
% Motorcycles	-	0.0	0.0	-	0.0	0.0	0.5	0.0	-	0.5	0.0	0.0	-	0.0	0.0	-	-	-	0.0	0.0	0.5
Cars & Light Goods	0	17	25	0	42	115	2435	6	0	2556	146	37	0	4	187	0	0	0	1	1	2786
% Cars & Light Goods	-	77.3	96.2	-	87.5	95.0	82.8	100.0	-	83.3	94.2	78.7	-	100.0	90.8	-	-	-	100.0	100.0	83.8
Buses	0	0	1	0	1	0	12	0	0	12	0	1	0	0	1	0	0	0	0	0	14
% Buses	-	0.0	3.8	-	2.1	0.0	0.4	0.0	-	0.4	0.0	2.1	-	0.0	0.5	-	-	-	0.0	0.0	0.4
Single-Unit Trucks	0	5	0	0	5	0	118	0	0	118	8	9	0	0	17	0	0	0	0	0	140
% Single-Unit Trucks	-	22.7	0.0	-	10.4	0.0	4.0	0.0	-	3.8	5.2	19.1	-	0.0	8.3	-	-	-	0.0	0.0	4.2
Articulated Trucks	0	0	0	0	0	6	361	0	0	367	1	0	0	0	1	0	0	0	0	0	368
% Articulated Trucks	-	0.0	0.0	-	0.0	5.0	12.3	0.0	-	12.0	0.6	0.0	-	0.0	0.5	-	-	-	0.0	0.0	11.1

GRAM Traffic NTX Inc.
1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: WB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018

Turning Movement Peak Hour Data (7:00 AM)

	FM 939 Southbound					SH 31 WB Westbound					FM 939 Northbound					Eastbound St. Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
7:00 AM	0	0	2	0	2	4	52	0	0	56	6	0	0	0	6	0	0	0	0	0	64
7:15 AM	0	0	4	0	4	2	86	0	0	88	6	0	0	0	6	0	0	0	0	0	98
7:30 AM	0	0	2	0	2	8	95	0	0	103	5	2	0	0	7	0	0	0	0	0	112
7:45 AM	0	0	0	0	0	2	56	0	0	58	8	1	0	0	9	0	0	0	0	0	67
Total	0	0	8	0	8	16	289	0	0	305	25	3	0	0	28	0	0	0	0	0	341
Approach %	0.0	0.0	100.0	0.0	-	5.2	94.8	0.0	0.0	-	89.3	10.7	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-
Total %	0.0	0.0	2.3	0.0	2.3	4.7	84.8	0.0	0.0	89.4	7.3	0.9	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	-
PHF	0.000	0.000	0.500	0.000	0.500	0.500	0.761	0.000	0.000	0.740	0.781	0.375	0.000	0.000	0.778	0.000	0.000	0.000	0.000	0.000	0.761
Motorcycles	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Motorcycles	-	-	0.0	-	0.0	0.0	0.3	-	-	0.3	0.0	0.0	-	-	0.0	-	-	-	-	-	0.3
Cars & Light Goods	0	0	7	0	7	15	260	0	0	275	25	3	0	0	28	0	0	0	0	0	310
% Cars & Light Goods	-	-	87.5	-	87.5	93.8	90.0	-	-	90.2	100.0	100.0	-	-	100.0	-	-	-	-	-	90.9
Buses	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Buses	-	-	12.5	-	12.5	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	-	-	-	-	-	0.3
Single-Unit Trucks	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	6
% Single-Unit Trucks	-	-	0.0	-	0.0	0.0	2.1	-	-	2.0	0.0	0.0	-	-	0.0	-	-	-	-	-	1.8
Articulated Trucks	0	0	0	0	0	1	22	0	0	23	0	0	0	0	0	0	0	0	0	0	23
% Articulated Trucks	-	-	0.0	-	0.0	6.3	7.6	-	-	7.5	0.0	0.0	-	-	0.0	-	-	-	-	-	6.7

GRAM Traffic NTX Inc.
1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: WB SH 31 @ FM 939
Site Code:
Start Date: 10/30/2018

Turning Movement Peak Hour Data (4:15 PM)

	FM 939					SH 31 WB					FM 939					Eastbound St.					
	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
4:15 PM	0	0	0	0	0	2	52	0	0	54	4	2	0	0	6	0	0	0	0	0	60
4:30 PM	0	4	0	0	4	2	45	0	0	47	0	0	0	0	0	0	0	0	0	0	51
4:45 PM	0	0	1	0	1	5	58	0	0	63	2	2	0	0	4	0	0	0	0	0	68
5:00 PM	0	0	2	0	2	1	55	0	0	56	6	2	0	0	8	0	0	0	0	0	66
Total	0	4	3	0	7	10	210	0	0	220	12	6	0	0	18	0	0	0	0	0	245
Approach %	0.0	57.1	42.9	0.0	-	4.5	95.5	0.0	0.0	-	66.7	33.3	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-
Total %	0.0	1.6	1.2	0.0	2.9	4.1	85.7	0.0	0.0	89.8	4.9	2.4	0.0	0.0	7.3	0.0	0.0	0.0	0.0	0.0	-
PHF	0.000	0.250	0.375	0.000	0.438	0.500	0.905	0.000	0.000	0.873	0.500	0.750	0.000	0.000	0.563	0.000	0.000	0.000	0.000	0.000	0.901
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	-	0.0	0.0	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	-	-	-	-	-	0.0
Cars & Light Goods	0	3	3	0	6	10	164	0	0	174	11	5	0	0	16	0	0	0	0	0	196
% Cars & Light Goods	-	75.0	100.0	-	85.7	100.0	78.1	-	-	79.1	91.7	83.3	-	-	88.9	-	-	-	-	-	80.0
Buses	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
% Buses	-	0.0	0.0	-	0.0	0.0	1.4	-	-	1.4	0.0	0.0	-	-	0.0	-	-	-	-	-	1.2
Single-Unit Trucks	0	1	0	0	1	0	9	0	0	9	1	1	0	0	2	0	0	0	0	0	12
% Single-Unit Trucks	-	25.0	0.0	-	14.3	0.0	4.3	-	-	4.1	8.3	16.7	-	-	11.1	-	-	-	-	-	4.9
Articulated Trucks	0	0	0	0	0	0	34	0	0	34	0	0	0	0	0	0	0	0	0	0	34
% Articulated Trucks	-	0.0	0.0	-	0.0	0.0	16.2	-	-	15.5	0.0	0.0	-	-	0.0	-	-	-	-	-	13.9

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: FM 939 @ HAPPY SWANER LN
Site Code:
Start Date: 12/05/2018
Page No: 1

Turning Movement Data

Start Time	FM 939 Southbound					HAPPY SWANER LN Westbound					FM 939 Northbound					HAPPY SWANER LN Eastbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
12:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1:00 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
1:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1:30 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	4
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
2:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
4:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 AM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
Hourly Total	0	1	0	0	1	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	5
5:00 AM	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
5:15 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
5:30 AM	0	4	0	0	4	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	8
5:45 AM	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
Hourly Total	0	9	0	0	9	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	20
6:00 AM	0	2	0	0	2	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	7
6:15 AM	0	2	0	0	2	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	6
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
6:45 AM	0	3	0	0	3	0	0	0	0	0	2	10	0	0	12	0	0	0	0	0	15
Hourly Total	0	7	0	0	7	0	0	0	0	0	2	22	0	0	24	0	0	0	0	0	31
7:00 AM	0	4	0	0	4	0	0	0	0	0	3	8	0	0	11	0	0	0	0	0	15
7:15 AM	0	6	0	0	6	0	0	0	0	0	2	10	0	0	12	0	0	1	0	1	19
7:30 AM	0	5	1	0	6	0	0	0	0	0	4	2	0	0	6	1	0	0	0	1	13
7:45 AM	0	3	0	0	3	0	0	0	0	0	2	5	0	0	7	1	0	1	0	2	12
Hourly Total	0	18	1	0	19	0	0	0	0	0	11	25	0	0	36	2	0	2	0	4	59
8:00 AM	0	3	0	0	3	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	11
8:15 AM	0	4	0	0	4	0	0	0	0	0	0	4	0	0	4	1	0	0	0	1	9
8:30 AM	0	4	0	0	4	0	0	0	0	0	0	5	0	0	5	1	0	0	0	1	10
8:45 AM	0	1	0	0	1	0	0	0	0	0	0	8	0	0	8	1	0	0	0	1	10
Hourly Total	0	12	0	0	12	0	0	0	0	0	0	25	0	0	25	3	0	0	0	3	40
9:00 AM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
9:15 AM	0	4	0	0	4	0	0	0	0	0	0	12	0	0	12	0	0	1	0	1	17
9:30 AM	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	6
9:45 AM	0	3	1	0	4	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	6
Hourly Total	0	9	1	0	10	0	0	0	0	0	0	21	0	0	21	0	0	1	0	1	32
10:00 AM	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	7
10:15 AM	0	4	0	0	4	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	6
10:30 AM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3
10:45 AM	0	2	0	1	3	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	6
Hourly Total	0	12	0	1	13	0	0	0	0	0	1	6	0	0	7	2	0	0	0	2	22
11:00 AM	0	3	0	0	3	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	10
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	3
11:30 AM	0	2	0	0	2	0	0	0	0	0	1	8	0	0	9	0	0	0	0	0	11
11:45 AM	0	3	0	0	3	0	0	0	0	0	0	10	0	0	10	0	0	1	0	1	14
Hourly Total	0	8	0	0	8	0	0	0	0	0	1	27	0	0	28	1	0	1	0	2	38
12:00 PM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	4
12:15 PM	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	1	0	0	0	1	7
12:30 PM	0	5	1	0	6	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	8

12:45 PM	0	8	1	0	9	0	0	0	0	0	1	5	0	0	6	0	0	0	0	0	15
Hourly Total	0	17	2	0	19	0	0	0	0	0	1	11	0	1	13	2	0	0	0	2	34
1:00 PM	0	5	2	0	7	0	0	0	0	0	0	4	0	0	4	2	0	0	0	2	13
1:15 PM	0	5	1	0	6	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	9
1:30 PM	0	7	0	0	7	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	8
1:45 PM	0	6	1	0	7	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	9
Hourly Total	0	23	4	0	27	0	0	0	0	0	0	10	0	0	10	2	0	0	0	2	39
2:00 PM	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	7
2:15 PM	0	5	1	0	6	0	0	0	0	0	0	5	0	0	5	1	0	0	0	1	12
2:30 PM	0	3	0	0	3	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	10
2:45 PM	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	7
Hourly Total	0	13	1	0	14	0	0	0	0	0	0	21	0	0	21	1	0	0	0	1	36
3:00 PM	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	1	0	0	0	1	5
3:15 PM	0	5	0	0	5	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	9
3:30 PM	0	8	0	0	8	0	0	0	0	0	1	6	0	0	7	0	0	2	0	2	17
3:45 PM	0	10	0	0	10	0	0	0	0	0	0	4	0	0	4	1	0	1	0	2	16
Hourly Total	0	24	0	0	24	0	0	0	0	0	2	16	0	0	18	2	0	3	0	5	47
4:00 PM	0	9	1	0	10	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	16
4:15 PM	0	7	1	0	8	0	0	0	0	0	1	7	0	0	8	0	0	0	0	0	16
4:30 PM	0	3	1	0	4	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	6
4:45 PM	0	5	1	0	6	0	0	0	0	0	0	8	0	0	8	0	0	1	0	1	15
Hourly Total	0	24	4	0	28	0	0	0	0	0	1	22	0	0	23	0	0	2	0	2	53
5:00 PM	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	0	0	2	0	2	10
5:15 PM	0	5	1	0	6	0	0	0	0	0	1	5	0	0	6	0	0	2	0	2	14
5:30 PM	0	9	1	0	10	0	0	0	0	0	1	6	0	0	7	0	0	2	0	2	19
5:45 PM	0	4	0	0	4	0	0	0	0	0	0	6	0	0	6	0	0	1	0	1	11
Hourly Total	0	23	2	0	25	0	0	0	0	0	2	20	0	0	22	0	0	7	0	7	54
6:00 PM	0	5	1	0	6	0	0	0	0	0	0	3	0	0	3	1	0	2	0	3	12
6:15 PM	0	6	0	0	6	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	11
6:30 PM	0	7	1	0	8	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	12
6:45 PM	0	3	0	0	3	0	0	0	0	0	2	3	0	0	5	0	0	0	0	0	8
Hourly Total	0	21	2	0	23	0	0	0	0	0	2	15	0	0	17	1	0	2	0	3	43
7:00 PM	0	3	0	0	3	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	7
7:15 PM	0	4	0	0	4	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	7
7:30 PM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
7:45 PM	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	1	0	1	5
Hourly Total	0	10	0	0	10	0	0	0	0	0	2	9	0	0	11	0	0	1	0	1	22
8:00 PM	0	5	0	0	5	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	6
8:15 PM	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
8:30 PM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
8:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	9	0	0	9	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	15
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	2
9:15 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	5
9:30 PM	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
9:45 PM	0	1	1	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
Hourly Total	0	7	1	0	8	0	0	0	0	0	0	2	0	0	2	0	0	4	0	4	14
10:00 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
10:15 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
10:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	6
11:00 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
11:15 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
11:30 PM	0	2	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
11:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	4	1	0	5	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	7
Grand Total	0	260	19	1	280	0	0	0	0	0	25	280	0	1	306	16	0	23	0	39	625
Approach %	0.0	92.9	6.8	0.4	-	0.0	0.0	0.0	0.0	-	8.2	91.5	0.0	0.3	-	41.0	0.0	59.0	0.0	-	-
Total %	0.0	41.6	3.0	0.2	44.8	0.0	0.0	0.0	0.0	0.0	4.0	44.8	0.0	0.2	49.0	2.6	0.0	3.7	0.0	6.2	-
Lights	0	243	17	1	261	0	0	0	0	0	21	265	0	0	286	16	0	22	0	38	585
% Lights	-	93.5	89.5	100.0	93.2	-	-	-	-	-	84.0	94.6	-	0.0	93.5	100.0	-	95.7	-	97.4	93.6
Mediums	0	10	1	0	11	0	0	0	0	0	4	3	0	1	8	0	0	1	0	1	20
% Mediums	-	3.8	5.3	0.0	3.9	-	-	-	-	-	16.0	1.1	-	100.0	2.6	0.0	-	4.3	-	2.6	3.2
Articulated Trucks	0	7	1	0	8	0	0	0	0	0	0	12	0	0	12	0	0	0	0	0	20
% Articulated Trucks	-	2.7	5.3	0.0	2.9	-	-	-	-	-	0.0	4.3	-	0.0	3.9	0.0	-	0.0	-	0.0	3.2

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: FM 939 @ HAPPY SWANER LN
Site Code:
Start Date: 12/05/2018

Turning Movement Peak Hour Data (6:45 AM)

Start Time	FM 939 Southbound Left	Thru	Right	U-Turn	App. Total	HAPPY SWANER LN Westbound Left	Thru	Right	U-Turn	App. Total	FM 939 Northbound Left	Thru	Right	U-Turn	App. Total	HAPPY SWANER LN Eastbound Left	Thru	Right	U-Turn	App. Total	Int. Total
6:45 AM	0	3	0	0	3	0	0	0	0	0	2	10	0	0	12	0	0	0	0	0	15
7:00 AM	0	4	0	0	4	0	0	0	0	0	3	8	0	0	11	0	0	0	0	0	15
7:15 AM	0	6	0	0	6	0	0	0	0	0	2	10	0	0	12	0	0	1	0	1	19
7:30 AM	0	5	1	0	6	0	0	0	0	0	4	2	0	0	6	1	0	0	0	1	13
Total	0	18	1	0	19	0	0	0	0	0	11	30	0	0	41	1	0	1	0	2	62
Approach %	0.0	94.7	5.3	0.0	-	0.0	0.0	0.0	0.0	-	26.8	73.2	0.0	0.0	-	50.0	0.0	50.0	0.0	-	-
Total %	0.0	29.0	1.6	0.0	30.6	0.0	0.0	0.0	0.0	0.0	17.7	48.4	0.0	0.0	66.1	1.6	0.0	1.6	0.0	3.2	-
PHF	0.000	0.750	0.250	0.000	0.792	0.000	0.000	0.000	0.000	0.000	0.688	0.750	0.000	0.000	0.854	0.250	0.000	0.250	0.000	0.500	0.816
Lights	0	17	1	0	18	0	0	0	0	0	10	30	0	0	40	1	0	1	0	2	60
% Lights	-	94.4	100.0	-	94.7	-	-	-	-	-	90.9	100.0	-	-	97.6	100.0	-	100.0	-	100.0	96.8
Mediums	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
% Mediums	-	5.6	0.0	-	5.3	-	-	-	-	-	9.1	0.0	-	-	2.4	0.0	-	0.0	-	0.0	3.2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	-	0.0	0.0	-	0.0	-	-	-	-	-	0.0	0.0	-	-	0.0	0.0	-	0.0	-	0.0	0.0

GRAM Traffic NTX Inc.
1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: FM 939 @ HAPPY SWANER LN
Site Code:
Start Date: 12/05/2018
Page No: 6

Turning Movement Peak Hour Data (3:30 PM)

	FM 939					HAPPY SWANER LN					FM 939					HAPPY SWANER LN					
	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
3:30 PM	0	8	0	0	8	0	0	0	0	0	1	6	0	0	7	0	0	2	0	2	17
3:45 PM	0	10	0	0	10	0	0	0	0	0	0	4	0	0	4	1	0	1	0	2	16
4:00 PM	0	9	1	0	10	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	16
4:15 PM	0	7	1	0	8	0	0	0	0	0	1	7	0	0	8	0	0	0	0	0	16
Total	0	34	2	0	36	0	0	0	0	0	2	23	0	0	25	1	0	3	0	4	65
Approach %	0.0	94.4	5.6	0.0	-	0.0	0.0	0.0	0.0	-	8.0	92.0	0.0	0.0	-	25.0	0.0	75.0	0.0	-	-
Total %	0.0	52.3	3.1	0.0	55.4	0.0	0.0	0.0	0.0	0.0	3.1	35.4	0.0	0.0	38.5	1.5	0.0	4.6	0.0	6.2	-
PHF	0.000	0.850	0.500	0.000	0.900	0.000	0.000	0.000	0.000	0.000	0.500	0.821	0.000	0.000	0.781	0.250	0.000	0.375	0.000	0.500	0.956
Lights	0	32	1	0	33	0	0	0	0	0	1	23	0	0	24	1	0	3	0	4	61
% Lights	-	94.1	50.0	-	91.7	-	-	-	-	-	50.0	100.0	-	-	96.0	100.0	-	100.0	-	100.0	93.8
Mediums	0	2	1	0	3	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	4
% Mediums	-	5.9	50.0	-	8.3	-	-	-	-	-	50.0	0.0	-	-	4.0	0.0	-	0.0	-	0.0	6.2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	-	0.0	0.0	-	0.0	-	-	-	-	-	0.0	0.0	-	-	0.0	0.0	-	0.0	-	0.0	0.0

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Count Name: FM 939 @ KIMBALL RD-CR 112
Site Code:
Start Date: 12/05/2018
Page No: 1

Turning Movement Data

	FM 939 Southbound					KIMBALL RD-CR 112 Westbound					FM 939 Northbound					Eastbound St. Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
12:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1:00 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
1:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1:30 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	4
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
2:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
4:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	4
5:00 AM	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
5:15 AM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:30 AM	0	4	0	0	4	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	8
5:45 AM	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	4
Hourly Total	0	8	0	0	8	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	18
6:00 AM	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	6
6:15 AM	0	2	0	0	2	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	7
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
6:45 AM	0	2	0	0	2	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	12
Hourly Total	0	7	0	0	7	0	0	0	0	0	0	21	0	0	21	0	0	0	0	0	28
7:00 AM	0	4	0	0	4	0	0	0	0	0	0	12	0	0	12	0	0	0	0	0	16
7:15 AM	1	6	0	0	7	1	0	0	0	1	0	8	1	0	9	0	0	0	0	0	17
7:30 AM	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	9
7:45 AM	0	4	0	0	4	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	12
Hourly Total	1	19	0	0	20	1	0	0	0	1	0	32	1	0	33	0	0	0	0	0	54
8:00 AM	0	1	0	0	1	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	9
8:15 AM	0	4	0	0	4	0	0	0	0	0	0	4	1	0	5	0	0	0	0	0	9
8:30 AM	0	4	0	0	4	0	0	1	0	1	0	2	0	0	2	0	0	0	0	0	7
8:45 AM	0	1	0	0	1	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	10
Hourly Total	0	10	0	0	10	0	0	1	0	1	0	23	1	0	24	0	0	0	0	0	35
9:00 AM	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	4
9:15 AM	0	5	0	0	5	0	0	1	0	1	0	10	0	0	10	0	0	0	0	0	16
9:30 AM	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	7
9:45 AM	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	4
Hourly Total	0	10	0	0	10	0	0	1	0	1	0	20	0	0	20	0	0	0	0	0	31
10:00 AM	1	4	0	0	5	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	8
10:15 AM	0	4	0	0	4	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	6
10:30 AM	1	1	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
10:45 AM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
Hourly Total	2	11	0	0	13	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	20
11:00 AM	0	2	0	0	2	0	0	0	0	0	0	7	0	1	8	0	0	0	0	0	10
11:15 AM	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	7
11:30 AM	0	3	0	0	3	0	0	0	0	0	0	8	1	0	9	0	0	0	0	0	12
11:45 AM	0	5	0	0	5	0	0	4	0	4	0	7	0	0	7	0	0	0	0	0	16
Hourly Total	0	11	0	0	11	0	0	4	0	4	0	28	1	1	30	0	0	0	0	0	45
12:00 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12:15 PM	0	3	0	0	3	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	7
12:30 PM	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4

12:45 PM	1	8	0	0	9	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	14
Hourly Total	1	14	0	0	15	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	26
1:00 PM	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	9
1:15 PM	0	6	0	0	6	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	8
1:30 PM	0	6	0	0	6	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	7
1:45 PM	1	5	0	0	6	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	11
Hourly Total	1	22	0	0	23	0	0	0	0	0	0	12	0	0	12	0	0	0	0	0	35
2:00 PM	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	5
2:15 PM	0	5	0	0	5	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	13
2:30 PM	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	7
2:45 PM	1	3	0	0	4	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	9
Hourly Total	1	13	0	0	14	0	0	0	0	0	0	20	0	0	20	0	0	0	0	0	34
3:00 PM	0	1	0	0	1	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	4
3:15 PM	0	4	0	0	4	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	9
3:30 PM	0	10	0	0	10	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	17
3:45 PM	0	8	0	0	8	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	13
Hourly Total	0	23	0	0	23	0	0	0	0	0	0	19	1	0	20	0	0	0	0	0	43
4:00 PM	1	10	0	0	11	0	0	0	1	1	0	7	0	0	7	0	0	0	0	0	19
4:15 PM	1	8	0	0	9	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	15
4:30 PM	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	5
4:45 PM	0	8	0	0	8	0	0	1	0	1	0	6	0	0	6	0	0	0	0	0	15
Hourly Total	2	29	0	0	31	0	0	1	1	2	0	21	0	0	21	0	0	0	0	0	54
5:00 PM	0	7	0	0	7	0	0	1	0	1	0	4	0	0	4	0	0	0	0	0	12
5:15 PM	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	8
5:30 PM	0	10	0	0	10	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	15
5:45 PM	1	5	0	0	6	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	11
Hourly Total	1	25	0	0	26	0	0	1	0	1	0	19	0	0	19	0	0	0	0	0	46
6:00 PM	0	7	0	0	7	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	10
6:15 PM	0	5	0	0	5	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	10
6:30 PM	0	7	0	0	7	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	11
6:45 PM	0	3	0	0	3	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	7
Hourly Total	0	22	0	0	22	0	0	0	0	0	0	16	0	0	16	0	0	0	0	0	38
7:00 PM	0	2	0	0	2	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	9
7:15 PM	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	5
7:30 PM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
7:45 PM	0	4	0	0	4	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	6
Hourly Total	0	11	0	0	11	1	0	0	0	1	0	11	0	0	11	0	0	0	0	0	23
8:00 PM	0	5	0	0	5	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	6
8:15 PM	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
8:30 PM	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	3
8:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	9	0	0	9	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	15
9:00 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
9:15 PM	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
9:30 PM	0	5	0	0	5	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	6
9:45 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hourly Total	0	11	0	0	11	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	13
10:00 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	3
10:15 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:30 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
10:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	6
11:00 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
11:15 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
11:30 PM	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	4	0	0	4	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	6
12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	9	268	0	0	277	2	0	8	1	11	0	289	4	1	294	0	0	0	0	0	582
Approach %	3.2	96.8	0.0	0.0	-	18.2	0.0	72.7	9.1	-	0.0	98.3	1.4	0.3	-	0.0	0.0	0.0	0.0	-	-
Total %	1.5	46.0	0.0	0.0	47.6	0.3	0.0	1.4	0.2	1.9	0.0	49.7	0.7	0.2	50.5	0.0	0.0	0.0	0.0	0.0	-
Lights	7	249	0	0	256	2	0	6	1	9	0	267	4	1	272	0	0	0	0	0	537
% Lights	77.8	92.9	-	-	92.4	100.0	-	75.0	100.0	81.8	-	92.4	100.0	100.0	92.5	-	-	-	-	-	92.3
Mediums	0	11	0	0	11	0	0	0	0	0	0	14	0	0	14	0	0	0	0	0	25
% Mediums	0.0	4.1	-	-	4.0	0.0	-	0.0	0.0	0.0	-	4.8	0.0	0.0	4.8	-	-	-	-	-	4.3
Articulated Trucks	2	8	0	0	10	0	0	2	0	2	0	8	0	0	8	0	0	0	0	0	20
% Articulated Trucks	22.2	3.0	-	-	3.6	0.0	-	25.0	0.0	18.2	-	2.8	0.0	0.0	2.7	-	-	-	-	-	3.4

GRAM Traffic NTX Inc.

1120 W. Lovers Lane

Arlington, Texas, United States 76013
817.265.8968

Turning Movement Peak Hour Data (6:45 AM)

	FM 939 Southbound					KIMBALL RD-CR 112 Westbound					FM 939 Northbound					Eastbound St. Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
6:45 AM	0	2	0	0	2	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	12
7:00 AM	0	4	0	0	4	0	0	0	0	0	0	12	0	0	12	0	0	0	0	0	16
7:15 AM	1	6	0	0	7	1	0	0	0	1	0	8	1	0	9	0	0	0	0	0	17
7:30 AM	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	9
Total	1	17	0	0	18	1	0	0	0	1	0	34	1	0	35	0	0	0	0	0	54
Approach %	5.6	94.4	0.0	0.0	-	100.0	0.0	0.0	0.0	-	0.0	97.1	2.9	0.0	-	0.0	0.0	0.0	0.0	-	-
Total %	1.9	31.5	0.0	0.0	33.3	1.9	0.0	0.0	0.0	1.9	0.0	63.0	1.9	0.0	64.8	0.0	0.0	0.0	0.0	0.0	-
PHF	0.250	0.708	0.000	0.000	0.643	0.250	0.000	0.000	0.000	0.250	0.000	0.708	0.250	0.000	0.729	0.000	0.000	0.000	0.000	0.000	0.794
Lights	1	17	0	0	18	1	0	0	0	1	0	32	1	0	33	0	0	0	0	0	52
% Lights	100.0	100.0	-	-	100.0	100.0	-	-	-	100.0	-	94.1	100.0	-	94.3	-	-	-	-	-	96.3
Mediums	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
% Mediums	0.0	0.0	-	-	0.0	0.0	-	-	-	0.0	-	2.9	0.0	-	2.9	-	-	-	-	-	1.9
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	-	-	-	0.0	-	2.9	0.0	-	2.9	-	-	-	-	-	1.9

GRAM Traffic NTX Inc.
1120 W. Lovers Lane
Arlington, Texas, United States 76013
817.265.8968

Count Name: FM 939 @ KIMBALL RD-CR 112
Site Code:
Start Date: 12/05/2018

Turning Movement Peak Hour Data (3:30 PM)

	FM 939 Southbound					KIMBALL RD-CR 112 Westbound					FM 939 Northbound					Eastbound St. Eastbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
3:30 PM	0	10	0	0	10	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	17
3:45 PM	0	8	0	0	8	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	13
4:00 PM	1	10	0	0	11	0	0	0	1	1	0	7	0	0	7	0	0	0	0	0	19
4:15 PM	1	8	0	0	9	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	15
Total	2	36	0	0	38	0	0	0	1	1	0	25	0	0	25	0	0	0	0	0	64
Approach %	5.3	94.7	0.0	0.0	-	0.0	0.0	0.0	100.0	-	0.0	100.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-
Total %	3.1	56.3	0.0	0.0	59.4	0.0	0.0	0.0	1.6	1.6	0.0	39.1	0.0	0.0	39.1	0.0	0.0	0.0	0.0	0.0	-
PHF	0.500	0.900	0.000	0.000	0.864	0.000	0.000	0.000	0.250	0.250	0.000	0.893	0.000	0.000	0.893	0.000	0.000	0.000	0.000	0.000	0.842
Lights	1	36	0	0	37	0	0	0	1	1	0	23	0	0	23	0	0	0	0	0	61
% Lights	50.0	100.0	-	-	97.4	-	-	-	100.0	100.0	-	92.0	-	-	92.0	-	-	-	-	-	95.3
Mediums	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
% Mediums	0.0	0.0	-	-	0.0	-	-	-	0.0	0.0	-	8.0	-	-	8.0	-	-	-	-	-	3.1
Articulated Trucks	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	50.0	0.0	-	-	2.6	-	-	-	0.0	0.0	-	0.0	-	-	0.0	-	-	-	-	-	1.6

GRAM Traffic North Texas, Inc.

1120 W. Lovers Lane
Arlington, TX 76013

EB SH 31 WEST OF FM 939 - SPEED WITH 4 SEC FILTER
Site Code: 73
Station ID:

Latitude: 0' 0.0000 South

EB

Start Time	1 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	96 999	Total	85th Percent	95th Percent
10/30/18	0	**1**	0	0	0	10	5	8	5	1	0	0	0	0	30	71	74
01:00	0	0	0	0	0	4	3	5	1	0	0	0	0	0	13	69	71
02:00	0	0	0	0	0	3	4	6	1	1	0	0	0	0	15	69	76
03:00	0	0	0	0	1	3	3	5	2	0	0	0	0	0	14	69	73
04:00	0	0	0	0	1	6	3	3	2	0	0	0	0	0	15	69	73
05:00	0	0	0	1	1	6	15	9	4	0	0	0	0	0	36	69	72
06:00	0	0	0	1	3	12	15	23	15	0	1	0	0	0	70	71	74
07:00	0	0	0	0	3	11	26	44	18	2	1	**1**	0	0	106	71	74
08:00	0	0	**1**	**2**	5	**23**	28	34	19	2	0	0	0	0	114	71	74
09:00	0	0	1	0	**6**	18	**44**	44	16	4	0	0	0	0	**133**	70	74
10:00	0	0	0	1	3	23	31	42	**23**	**7**	**2**	0	0	0	132	72	76
11:00	0	0	0	0	2	23	33	**47**	20	4	0	0	0	0	129	71	74
12 PM	**1**	0	0	1	4	**19**	**42**	61	23	4	0	0	0	0	155	70	74
13:00	0	0	0	0	**8**	19	37	60	34	7	0	1	0	0	166	72	74
14:00	0	0	0	0	2	15	24	**75**	39	9	0	0	0	0	164	73	75
15:00	0	**1**	**2**	**2**	5	14	34	62	46	18	3	1	0	0	188	74	78
16:00	0	0	0	1	2	13	25	67	**70**	20	**6**	**2**	0	0	**206**	74	79
17:00	1	0	0	0	3	11	19	59	66	**34**	2	1	**1**	0	197	76	79
18:00	0	0	0	1	1	7	32	56	63	20	4	0	1	0	185	74	78
19:00	0	0	0	2	2	9	28	34	34	13	2	0	0	0	124	74	78
20:00	0	0	0	0	0	3	23	43	35	10	4	0	0	0	118	74	79
21:00	0	0	0	0	0	6	22	27	28	8	1	0	0	0	92	74	77
22:00	0	0	0	0	0	8	10	17	25	3	1	0	0	0	64	73	76
23:00	0	0	0	0	0	7	13	13	13	5	0	0	0	0	51	73	77
Total	2	2	4	12	52	273	519	844	602	172	27	6	2	0	2517		
Percent	0.1%	0.1%	0.2%	0.5%	2.1%	10.8%	20.6%	33.5%	23.9%	6.8%	1.1%	0.2%	0.1%	0.0%			
AM Peak		00:00	08:00	08:00	09:00	08:00	09:00	11:00	10:00	10:00	10:00	07:00			09:00		
Vol.		1	1	2	6	23	44	47	23	7	2	1			133		
PM Peak	12:00	15:00	15:00	15:00	13:00	12:00	12:00	14:00	16:00	17:00	16:00	16:00	17:00		16:00		
Vol.	1	1	2	2	8	19	42	75	70	34	6	2	1		206		
Total	2	2	4	12	52	273	519	844	602	172	27	6	2	0	2517		
Percent	0.1%	0.1%	0.2%	0.5%	2.1%	10.8%	20.6%	33.5%	23.9%	6.8%	1.1%	0.2%	0.1%	0.0%			

	15th Percentile :	60 MPH
	50th Percentile :	67 MPH
	85th Percentile :	73 MPH
	95th Percentile :	77 MPH
Stats	10 MPH Pace Speed :	66-75 MPH
	Number in Pace :	1446
	Percent in Pace :	57.4%
	Number of Vehicles > 55 MPH :	2445
	Percent of Vehicles > 55 MPH :	97.1%
	Mean Speed(Average) :	67 MPH

GRAM Traffic North Texas, Inc.

1120 W. Lovers Lane
Arlington, TX 76013

WB SH 31 EAST OF FM 939 - SPEED W 4 SEC FILTER
Site Code: 922
Station ID:

Latitude: 0' 0.0000 Undefined

WB

Start Time	1 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	96 999	Total	85th Percent	95th Percent
10/30/18	0	0	0	1	0	1	1	2	8	1	3	0	0	0	17	80	83
01:00	0	0	0	0	0	0	1	3	4	1	2	1	0	0	12	82	86
02:00	0	0	0	0	0	0	0	2	2	3	1	0	0	**1**	9	79	82
03:00	0	0	0	0	0	1	4	7	3	3	2	1	0	1	22	79	84
04:00	0	0	0	0	0	0	1	5	10	13	6	1	0	0	36	81	84
05:00	0	0	0	**2**	0	8	15	18	16	13	9	4	0	0	85	80	84
06:00	0	**1**	0	0	2	**11**	**16**	21	40	36	20	5	1	0	153	80	84
07:00	0	0	**2**	0	0	7	13	**36**	**49**	**54**	24	**13**	**2**	1	**201**	81	86
08:00	0	0	0	1	**4**	3	15	30	39	36	19	7	0	1	155	80	84
09:00	0	0	0	0	0	3	15	29	40	52	13	4	1	0	157	79	83
10:00	0	0	0	0	2	5	11	26	33	42	18	2	0	0	139	79	83
11:00	0	0	0	0	0	4	11	32	32	42	**25**	2	0	0	148	80	83
12 PM	0	0	0	0	**2**	1	9	29	38	42	18	**7**	0	0	146	80	84
13:00	0	0	0	0	1	1	12	26	39	36	18	5	1	0	139	80	84
14:00	0	0	0	**2**	0	2	19	17	50	**55**	16	7	0	0	168	79	84
15:00	0	0	0	2	0	3	16	16	**57**	47	**23**	6	1	0	**171**	80	84
16:00	0	0	0	0	2	2	16	27	41	37	21	4	2	0	152	80	84
17:00	0	0	0	0	0	**5**	**20**	**31**	36	30	22	7	0	0	151	81	84
18:00	0	0	0	0	2	3	13	22	21	29	10	6	**3**	0	109	81	87
19:00	0	0	**2**	0	1	5	11	23	13	13	10	2	1	0	81	80	84
20:00	0	0	0	0	2	1	4	13	19	22	5	3	2	0	71	79	87
21:00	0	0	0	0	0	2	1	15	9	20	7	4	0	0	58	81	86
22:00	0	0	0	0	1	3	7	8	3	4	3	0	1	**1**	31	79	84
23:00	0	0	0	0	1	1	3	2	8	9	4	1	1	0	30	81	87
Total	0	1	4	8	20	72	234	440	610	640	299	92	16	5	2441		
Percent	0.0%	0.0%	0.2%	0.3%	0.8%	2.9%	9.6%	18.0%	25.0%	26.2%	12.2%	3.8%	0.7%	0.2%			
AM Peak		06:00	07:00	05:00	08:00	06:00	06:00	07:00	07:00	07:00	11:00	07:00	07:00	02:00	07:00		
Vol.		1	2	2	4	11	16	36	49	54	25	13	2	1	201		
PM Peak			19:00	14:00	12:00	17:00	17:00	17:00	15:00	14:00	15:00	12:00	18:00	22:00	15:00		
Vol.			2	2	2	5	20	31	57	55	23	7	3	1	171		
Total	0	1	4	8	20	72	234	440	610	640	299	92	16	5	2441		
Percent	0.0%	0.0%	0.2%	0.3%	0.8%	2.9%	9.6%	18.0%	25.0%	26.2%	12.2%	3.8%	0.7%	0.2%			

	15th Percentile :	65 MPH
	50th Percentile :	73 MPH
	85th Percentile :	80 MPH
	95th Percentile :	84 MPH
Stats	10 MPH Pace Speed :	71-80 MPH
	Number in Pace :	1250
	Percent in Pace :	51.2%
	Number of Vehicles > 55 MPH :	2408
	Percent of Vehicles > 55 MPH :	98.6%
	Mean Speed(Average) :	74 MPH

EB SH 31 WEST OF FM 939 - GAP

Date	Time	1-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-999	TOTAL
10/30/2018	12:00 AM	0	0	0	1	0	0	0	0	0	0	1	0	0	8	10
10/30/2018	12:15 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	6	7
10/30/2018	12:30 AM	1	0	0	0	0	0	0	0	0	0	0	1	1	6	9
10/30/2018	12:45 AM	2	0	1	0	0	0	0	0	0	0	0	0	0	4	7
10/30/2018	01:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
10/30/2018	01:15 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	2	3
10/30/2018	01:30 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	3	4
10/30/2018	01:45 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	4	5
10/30/2018	02:00 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	3	4
10/30/2018	02:15 AM	1	0	0	0	0	0	0	0	1	0	0	0	0	4	6
10/30/2018	02:30 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	4	5
10/30/2018	02:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10/30/2018	03:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	5	6
10/30/2018	03:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
10/30/2018	03:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10/30/2018	03:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10/30/2018	04:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
10/30/2018	04:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4
10/30/2018	04:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
10/30/2018	04:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
10/30/2018	05:00 AM	3	0	0	0	0	0	0	0	0	0	0	1	0	4	8
10/30/2018	05:15 AM	2	0	2	0	0	0	0	0	0	0	0	0	1	5	10
10/30/2018	05:30 AM	0	0	0	0	0	0	0	0	0	1	0	0	0	4	5
10/30/2018	05:45 AM	8	1	1	0	1	2	0	0	1	0	0	1	0	9	24
10/30/2018	06:00 AM	1	1	0	0	2	0	0	0	0	1	0	0	1	7	13
10/30/2018	06:15 AM	2	0	0	1	2	1	0	0	0	0	1	0	0	11	18
10/30/2018	06:30 AM	2	2	0	1	1	0	1	2	0	0	2	2	0	9	22
10/30/2018	06:45 AM	7	3	0	1	0	0	0	0	0	0	1	0	2	11	25
10/30/2018	07:00 AM	2	0	2	0	2	2	0	0	0	0	0	0	1	10	19
10/30/2018	07:15 AM	6	1	0	1	1	1	0	0	0	2	2	0	1	14	29
10/30/2018	07:30 AM	11	5	3	1	1	4	2	2	1	1	1	2	1	11	46
10/30/2018	07:45 AM	7	2	2	1	0	1	2	0	3	3	0	0	2	11	34
10/30/2018	08:00 AM	4	1	2	0	3	3	3	0	3	0	0	0	0	12	31
10/30/2018	08:15 AM	3	3	4	1	0	5	2	1	4	0	1	1	1	10	36
10/30/2018	08:30 AM	8	2	3	1	0	2	2	1	1	0	1	3	2	11	37
10/30/2018	08:45 AM	7	2	1	2	1	4	0	0	0	0	0	1	0	13	31
10/30/2018	09:00 AM	3	3	1	0	1	1	1	1	1	1	0	1	3	9	26
10/30/2018	09:15 AM	3	5	2	2	1	0	0	1	1	0	3	0	1	13	32
10/30/2018	09:30 AM	7	9	3	2	2	2	0	4	3	1	5	2	1	9	50
10/30/2018	09:45 AM	12	4	2	3	1	0	4	1	1	2	2	0	1	12	45
10/30/2018	10:00 AM	10	2	1	6	3	4	0	1	3	3	0	1	2	10	46
10/30/2018	10:15 AM	4	3	1	4	1	0	2	2	0	3	2	0	2	11	35
10/30/2018	10:30 AM	9	4	1	3	2	2	2	1	2	0	1	0	1	11	39
10/30/2018	10:45 AM	8	2	0	1	1	3	3	3	0	2	1	0	1	10	35
10/30/2018	11:00 AM	9	0	3	1	1	0	0	1	1	0	2	1	1	12	32
10/30/2018	11:15 AM	14	3	2	2	2	2	3	0	0	0	1	1	0	11	41
10/30/2018	11:30 AM	11	7	0	8	4	2	2	2	2	1	3	1	0	6	49
10/30/2018	11:45 AM	8	4	1	3	2	5	1	0	3	1	0	1	0	11	40

EB SH 31 WEST OF FM 939 - GAP

Date	Time	1-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-999	TOTAL
10/30/2018	12:00 PM	11	7	4	5	2	4	2	1	3	0	0	0	1	11	51
10/30/2018	12:15 PM	5	5	0	6	3	3	3	1	0	3	3	0	1	8	41
10/30/2018	12:30 PM	13	2	3	1	2	3	3	1	1	1	1	0	2	12	45
10/30/2018	12:45 PM	9	4	4	4	3	0	3	6	3	3	0	1	1	8	49
10/30/2018	01:00 PM	9	3	2	4	3	3	0	3	5	2	2	0	2	9	47
10/30/2018	01:15 PM	4	7	2	2	2	1	2	1	5	3	1	0	0	9	39
10/30/2018	01:30 PM	23	5	8	3	4	5	2	4	0	2	0	0	1	10	67
10/30/2018	01:45 PM	20	4	4	2	0	3	2	2	1	3	2	1	1	11	56
10/30/2018	02:00 PM	10	5	3	3	2	3	3	2	0	2	1	0	0	11	45
10/30/2018	02:15 PM	15	1	1	2	1	4	4	3	0	3	0	0	0	13	47
10/30/2018	02:30 PM	26	7	4	5	5	2	3	1	3	2	5	3	1	5	72
10/30/2018	02:45 PM	10	1	6	3	1	3	1	2	3	3	4	0	3	9	49
10/30/2018	03:00 PM	14	12	4	6	1	2	4	0	3	1	1	2	3	9	62
10/30/2018	03:15 PM	22	9	2	4	4	1	2	1	4	4	4	0	0	9	66
10/30/2018	03:30 PM	7	2	6	4	3	5	3	3	2	0	1	1	1	9	47
10/30/2018	03:45 PM	13	5	4	3	5	2	2	5	4	2	0	1	3	8	57
10/30/2018	04:00 PM	23	3	3	6	6	5	1	1	1	3	2	0	0	10	64
10/30/2018	04:15 PM	27	11	8	4	2	3	3	2	0	6	2	2	3	6	79
10/30/2018	04:30 PM	17	7	8	6	4	3	4	2	4	1	1	0	1	8	66
10/30/2018	04:45 PM	21	7	4	4	8	3	1	4	1	5	0	0	2	8	68
10/30/2018	05:00 PM	19	8	3	3	2	1	5	5	4	2	2	2	1	6	63
10/30/2018	05:15 PM	33	5	4	5	1	2	3	5	1	1	3	2	2	8	75
10/30/2018	05:30 PM	31	8	9	3	3	3	5	0	1	2	1	1	3	8	78
10/30/2018	05:45 PM	40	5	6	6	4	5	3	0	1	0	3	1	2	9	85
10/30/2018	06:00 PM	27	7	4	6	1	1	7	1	0	1	1	2	1	12	71
10/30/2018	06:15 PM	11	8	3	2	1	3	2	2	1	1	1	1	2	12	50
10/30/2018	06:30 PM	14	9	5	4	4	1	2	2	0	3	3	3	3	7	60
10/30/2018	06:45 PM	14	4	3	2	4	2	5	4	3	1	0	1	1	10	54
10/30/2018	07:00 PM	10	3	1	5	1	5	2	0	1	2	2	2	1	9	44
10/30/2018	07:15 PM	9	1	2	1	1	2	1	1	0	1	1	0	1	15	36
10/30/2018	07:30 PM	6	3	3	2	0	0	1	1	1	0	0	1	0	16	34
10/30/2018	07:45 PM	7	0	2	3	0	2	3	2	2	0	3	1	1	12	38
10/30/2018	08:00 PM	7	3	4	2	3	2	0	1	1	3	2	0	0	10	38
10/30/2018	08:15 PM	1	1	0	2	4	1	2	1	2	3	2	1	0	7	27
10/30/2018	08:30 PM	5	4	2	1	2	0	0	1	0	3	2	1	0	12	33
10/30/2018	08:45 PM	6	1	1	2	1	2	4	3	2	0	0	0	1	13	36
10/30/2018	09:00 PM	4	4	2	2	0	1	0	0	1	0	0	0	0	13	27
10/30/2018	09:15 PM	5	2	2	0	2	2	0	0	1	1	1	3	0	8	27
10/30/2018	09:30 PM	3	4	2	2	1	2	1	1	0	0	1	1	0	12	30
10/30/2018	09:45 PM	1	0	0	1	0	0	1	2	0	1	1	0	3	9	19
10/30/2018	10:00 PM	1	2	0	0	1	1	0	0	1	2	0	1	0	11	20
10/30/2018	10:15 PM	2	1	1	1	1	1	0	0	0	0	0	0	0	11	18
10/30/2018	10:30 PM	4	0	1	0	0	0	0	1	0	0	1	0	0	13	20
10/30/2018	10:45 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	7	9
10/30/2018	11:00 PM	1	0	0	0	0	1	0	0	1	0	1	2	0	7	13
10/30/2018	11:15 PM	0	0	2	0	0	1	1	0	0	0	0	0	0	8	12
10/30/2018	11:30 PM	1	1	1	2	0	1	0	0	0	1	0	0	0	10	17
10/30/2018	11:45 PM	1	0	0	1	0	0	0	0	1	0	0	0	2	7	12
	TOTAL	**741**	**260**	**182**	**181**	**133**	**146**	**126**	**102**	**99**	**99**	**93**	**58**	**77**	**819**	**3116**

WB SH 31 EAST OF FM 939 - GAP

Date	Time	1-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-999	TOTAL
10/30/2018	12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4
10/30/2018	12:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
10/30/2018	12:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10/30/2018	12:45 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	5	6
10/30/2018	01:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10/30/2018	01:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
10/30/2018	01:30 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	4	5
10/30/2018	01:45 AM	2	0	0	0	0	0	0	0	0	0	0	0	0	4	6
10/30/2018	02:00 AM	2	0	0	0	0	0	0	0	0	0	0	0	0	2	4
10/30/2018	02:15 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	3	4
10/30/2018	02:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/30/2018	02:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
10/30/2018	03:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
10/30/2018	03:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
10/30/2018	03:30 AM	0	0	0	0	0	0	0	0	0	1	0	0	2	2	5
10/30/2018	03:45 AM	0	0	1	0	0	0	0	0	0	1	0	0	0	6	8
10/30/2018	04:00 AM	2	0	0	0	0	0	0	0	0	0	0	0	0	6	8
10/30/2018	04:15 AM	1	1	0	0	0	1	0	0	0	0	0	0	0	7	10
10/30/2018	04:30 AM	1	0	0	0	0	0	0	1	1	2	1	1	0	6	13
10/30/2018	04:45 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	7	8
10/30/2018	05:00 AM	2	2	0	1	1	0	1	0	1	0	0	0	2	10	20
10/30/2018	05:15 AM	13	1	1	3	3	0	1	0	1	1	0	0	2	9	35
10/30/2018	05:30 AM	7	5	1	1	1	1	1	0	0	0	0	1	0	13	31
10/30/2018	05:45 AM	4	0	0	1	0	1	2	0	1	0	2	0	1	10	22
10/30/2018	06:00 AM	9	2	1	4	1	1	0	2	2	0	5	1	0	10	38
10/30/2018	06:15 AM	10	5	4	5	2	1	2	4	1	0	2	0	2	12	50
10/30/2018	06:30 AM	10	3	4	2	2	1	3	3	1	2	0	1	1	9	42
10/30/2018	06:45 AM	18	5	7	5	0	3	2	4	2	3	2	1	0	9	61
10/30/2018	07:00 AM	22	5	6	4	2	4	2	0	1	3	4	1	2	8	64
10/30/2018	07:15 AM	41	6	6	7	4	5	1	2	3	0	3	1	2	7	88
10/30/2018	07:30 AM	34	7	8	11	5	7	3	2	2	3	1	0	1	6	90
10/30/2018	07:45 AM	15	3	3	6	3	2	3	1	3	0	1	0	0	12	52
10/30/2018	08:00 AM	23	3	1	3	3	4	3	3	1	2	2	2	1	9	60
10/30/2018	08:15 AM	20	7	3	0	5	1	0	1	1	1	0	0	2	13	54
10/30/2018	08:30 AM	13	1	5	5	5	2	0	3	1	0	2	1	1	10	49
10/30/2018	08:45 AM	13	5	4	3	1	2	1	2	4	1	1	1	0	12	50
10/30/2018	09:00 AM	13	0	1	4	3	2	0	0	0	0	1	0	3	14	41
10/30/2018	09:15 AM	26	8	4	2	2	3	3	3	0	1	1	2	1	10	66
10/30/2018	09:30 AM	18	2	3	2	0	2	2	0	2	2	3	1	1	12	50
10/30/2018	09:45 AM	10	9	5	3	4	2	2	2	1	3	1	0	1	11	54
10/30/2018	10:00 AM	14	5	4	3	1	2	1	1	2	2	3	1	0	11	50
10/30/2018	10:15 AM	13	1	1	3	2	1	2	1	0	0	4	3	1	9	41
10/30/2018	10:30 AM	8	2	2	4	1	3	1	0	1	2	1	2	2	11	40
10/30/2018	10:45 AM	10	3	3	1	2	1	4	5	2	0	3	0	2	11	47
10/30/2018	11:00 AM	12	4	3	3	2	8	1	0	0	2	0	0	2	10	47
10/30/2018	11:15 AM	16	3	5	2	3	2	1	2	3	1	2	0	0	10	50
10/30/2018	11:30 AM	11	6	4	3	2	1	0	0	1	1	1	2	1	12	45
10/30/2018	11:45 AM	12	3	4	4	1	2	2	0	2	0	1	1	1	10	43

WB SH 31 EAST OF FM 939 - GAP

Date	Time	1-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-999	TOTAL
10/30/2018	12:00 PM	15	1	3	0	1	1	1	3	6	2	0	1	0	11	45
10/30/2018	12:15 PM	10	6	0	5	5	1	2	2	1	1	0	0	0	11	44
10/30/2018	12:30 PM	15	3	5	5	2	5	0	2	1	0	1	0	2	8	49
10/30/2018	12:45 PM	17	4	7	3	3	1	2	5	2	0	2	0	0	11	57
10/30/2018	01:00 PM	14	7	2	5	1	2	1	0	1	1	2	1	1	12	50
10/30/2018	01:15 PM	4	2	3	2	2	2	0	1	2	0	1	0	2	10	31
10/30/2018	01:30 PM	13	2	3	3	3	1	1	0	1	4	0	1	1	12	45
10/30/2018	01:45 PM	15	3	7	4	1	3	2	3	3	2	2	1	0	10	56
10/30/2018	02:00 PM	15	3	7	2	4	1	1	1	3	1	3	1	0	11	53
10/30/2018	02:15 PM	9	4	4	4	3	4	1	2	1	2	0	2	1	9	46
10/30/2018	02:30 PM	14	8	1	0	3	4	1	1	3	1	1	0	0	8	45
10/30/2018	02:45 PM	15	8	10	5	2	3	2	1	0	3	1	2	1	9	62
10/30/2018	03:00 PM	16	7	3	6	2	3	4	2	1	3	0	0	0	11	58
10/30/2018	03:15 PM	21	6	1	7	4	1	2	3	3	0	0	1	1	11	61
10/30/2018	03:30 PM	27	8	5	6	3	2	1	3	2	2	0	0	1	8	68
10/30/2018	03:45 PM	13	4	1	4	7	0	3	1	1	1	1	0	3	10	49
10/30/2018	04:00 PM	9	5	3	3	5	4	6	4	2	0	1	0	1	7	50
10/30/2018	04:15 PM	13	6	3	2	4	0	1	1	2	0	2	1	2	6	43
10/30/2018	04:30 PM	8	7	6	5	2	4	1	1	1	1	0	1	0	9	46
10/30/2018	04:45 PM	10	6	2	3	1	5	1	3	2	2	2	2	1	9	49
10/30/2018	05:00 PM	10	6	4	3	2	0	1	2	0	1	0	2	0	11	42
10/30/2018	05:15 PM	27	7	3	3	2	0	4	2	1	2	0	2	2	9	64
10/30/2018	05:30 PM	12	2	6	0	3	7	4	3	0	0	0	1	2	8	48
10/30/2018	05:45 PM	15	2	7	1	3	1	2	2	1	2	4	0	2	11	53
10/30/2018	06:00 PM	21	1	1	4	3	1	1	1	1	1	1	2	3	10	51
10/30/2018	06:15 PM	12	2	3	4	3	4	2	0	4	1	0	0	1	8	44
10/30/2018	06:30 PM	6	3	0	1	1	2	2	1	2	0	0	3	0	8	29
10/30/2018	06:45 PM	4	2	2	1	1	1	3	1	0	0	0	0	0	11	26
10/30/2018	07:00 PM	8	5	0	1	3	3	2	1	0	2	1	1	0	9	36
10/30/2018	07:15 PM	4	1	1	0	1	1	0	1	0	0	1	0	2	8	20
10/30/2018	07:30 PM	1	1	3	0	0	0	0	1	0	0	0	1	2	9	18
10/30/2018	07:45 PM	1	4	0	1	0	0	0	0	1	0	2	0	0	10	19
10/30/2018	08:00 PM	1	1	1	0	2	0	0	0	2	0	0	0	0	7	14
10/30/2018	08:15 PM	3	2	1	0	1	0	0	0	0	0	2	1	0	10	20
10/30/2018	08:30 PM	2	0	0	1	3	0	0	0	0	2	0	0	0	6	14
10/30/2018	08:45 PM	10	2	3	0	4	2	1	1	1	0	1	4	1	7	37
10/30/2018	09:00 PM	4	0	1	0	2	0	2	1	0	0	2	0	0	10	22
10/30/2018	09:15 PM	5	1	0	0	1	0	2	0	0	0	1	0	0	9	19
10/30/2018	09:30 PM	2	1	0	0	0	0	0	0	0	0	1	1	1	8	14
10/30/2018	09:45 PM	1	1	1	0	0	0	0	0	0	0	0	0	0	8	11
10/30/2018	10:00 PM	2	0	0	0	0	0	0	0	0	0	0	0	1	5	8
10/30/2018	10:15 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	9	10
10/30/2018	10:30 PM	2	0	0	0	0	0	0	1	0	1	0	0	0	9	13
10/30/2018	10:45 PM	1	0	0	0	0	0	0	0	0	0	0	0	0	4	5
10/30/2018	11:00 PM	1	0	0	0	2	0	1	0	0	0	0	0	0	7	11
10/30/2018	11:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
10/30/2018	11:30 PM	0	0	0	1	0	0	0	0	1	0	1	0	0	4	7
10/30/2018	11:45 PM	2	0	0	0	0	0	0	0	0	0	0	0	0	6	8
	TOTAL	**856**	**251**	**207**	**191**	**156**	**135**	**104**	**99**	**93**	**72**	**84**	**55**	**69**	**789**	**3161**

INBOUND VEHICLE TRAFFIC AT CITY OF WACO LANDFILL, TCEQ PERMIT NO. 948A
AVERAGE DAILY ANALYSIS
TIME PERIOD: 9/1/17 THROUGH 8/31/18

Day of Week	Total Vehicles[1]	Total Days Operated[2]	Average Daily Vehicles
Weekday			
Monday	20751	48	432
Tuesday	19818	52	381
Wednesday	17276	51	339
Thursday	19227	51	377
Friday	20152	53	380
Total Weekday	**97224**	**255**	**381**
Weekend			
Saturday	9052	52	174
Sunday	0	0	0
Total Weekend	**9052**	**52**	**174**

Days Not Operated
Monday, September 4, 2017
Thursday, November 23, 2017
Monday, December 25, 2017
Monday, January 1, 2018
Monday, May 28, 2018
Wednesday, July 4, 2018

2018 Weighted Average[3]:	**362**
2018 Weekday Average[4]:	**381**
Growth Rate[5]:	**1.25%**

Notes:
1. Total number of vehicles entering the site on each day of operation excluding holidays observed during the time period, including 9/4/17, 11/23/17, 12/25/17, 1/1/18, 5/28/18, 7/4/18.
2. Represents the total operating days during the time period for each respective day.
3. Represents the weighted average between average vehicles per day on weekdays and weekends.
4. Represents the average vehicles per days on weekdays. This average was conservatively used for future vehicle projections, due to reduced the site operations and traffic on weekends.
5. Average growth rate for McLennan County between 2010 and 2016, as reported in City of Waco Landfill, TCEQ Permit No. 2400, Parts I/II, Appendix I/IIC.

INBOUND VEHICLE TRAFFIC AT CITY OF WACO LANDFILL, TCEQ PERMIT NO. 2400
AVERAGE DAILY PROJECTIONS
TIME PERIOD: 2019 THROUGH 2059

Vehicle Projections[1]		
Year	**Vehicles per day**	**Assumptions**
2019	386	
2020	391	
2021	396	
2022	401	
2023	406	
2024	**411**	**Assumed Site Opening**
2025	416	
2026	421	
2027	426	
2028	431	
2029	436	
2030	441	
2031	447	
2032	453	
2033	459	
2034	465	
2035	471	
2036	477	
2037	483	
2038	489	
2039	495	
2040	501	
2041	507	
2042	513	
2043	519	
2044	525	
2045	532	
2046	539	
2047	546	
2048	553	
2049	560	
2050	567	
2051	574	
2052	581	
2053	588	
2054	595	
2055	602	
2056	610	
2057	618	
2058	626	
2059	**634**	**Assumed Site Closure**

Notes:
1. Based on average annual growth rate for McLennan County of 1.25 percent.

INBOUND VEHICLE TRAFFIC AT CITY OF WACO LANDFILL, TCEQ PERMIT NO. 948A
PEAK HOURLY ANALYSIS
TIME PERIOD: 9/1/17 THROUGH 8/31/18

Peak Hourly - Weekdays

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
5	0	0	0	0.0%
6	178	1	4	0.6%
7	5978	23	39	6.1%
8	9750	38	65	10.2%
9	9949	39	66	10.4%
10	11068	43	63	9.9%
11	11121	44	64	10.1%
12	10979	43	67	10.5%
13	11579	45	64	10.1%
14	11026	43	75	11.8%
15	9863	39	63	9.9%
16	5150	20	44	6.9%
17	340	1	13	2.0%
18	241	1	9	1.4%
19	0	0	0	0.0%
Total:	**97222**		**636**	**100.0%**

Peak Hourly - Weekend

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
5	0	0	0	0.0%
6	0	0	0	0.0%
7	70	1	12	4.3%
8	2375	46	71	25.4%
9	2399	46	63	22.6%
10	2603	50	65	23.3%
11	1601	31	65	23.3%
12	4	0	3	1.1%
13	0	0	0	0.0%
Total:	**9052**		**279**	**100.0%**

TxDOT AM Hourly - Weekdays

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
7	5978	23	39	37.50%
8	9750	38	65	62.50%
Total:	**15728**		**104**	**100.00%**

TxDOT AM Hourly - Weekend

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
7	70	1	12	14.46%
8	2375	46	71	85.54%
Total:	**2445**		**83**	**100.00%**

TxDOT PM Hourly - Weekdays

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
15	9863	39	63	52.50%
16	5150	20	44	36.67%
17	340	1	13	10.83%
Total:	**15353**		**120**	**100.00%**

TxDOT PM Hourly - Weekend

Hour	Total Vehicles/yr/hr	Average Vehicles/day/hr	Peak Vehicles/hr	Peak %
15	0	0	0	0.00%
16	0	0	0	0.00%
17	0	0	0	0.00%
Total:	**0**		**0**	**0.00%**

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Future Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	10	10	10	12	12	12	12	12	12
Mvmt Flow	0	0	0	21	380	0	33	4	0	0	0	11

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	232	422	-	-	422	190
Stage 1	-	-	-	0	0	-	-	422	-
Stage 2	-	-	-	232	422	-	-	0	-
Critical Hdwy	4.3	-	-	7.74	6.74	-	-	6.74	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.74	-
Critical Hdwy Stg 2	-	-	-	6.74	5.74	-	-	-	-
Follow-up Hdwy	2.3	-	-	3.62	4.12	-	-	4.12	3.42
Pot Cap-1 Maneuver	-	-	-	677	500	0	0	500	789
Stage 1	-	-	-	-	-	0	0	562	-
Stage 2	-	-	-	722	562	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	668	500	-	-	500	789
Mov Cap-2 Maneuver	-	-	-	668	500	-	-	500	-
Stage 1	-	-	-	-	-	-	-	562	-
Stage 2	-	-	-	712	562	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		10.9	9.6
HCM LOS		B	A

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	645	-	-	-	789
HCM Lane V/C Ratio	0.057	-	-	-	0.013
HCM Control Delay (s)	10.9	-	-	-	9.6
HCM Lane LOS	B	-	-	-	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Future Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	92	92	92	94	94	94	94	94	94
Heavy Vehicles, %	16	16	16	2	2	2	7	7	7	7	7	7
Mvmt Flow	2	140	11	0	0	0	0	28	19	0	16	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	144	70	88	144	-
Stage 1	-	-	-				-	144	-	0	0	-
Stage 2	-	-	-				-	0	-	88	144	-
Critical Hdwy	4.42	-	-				-	6.64	7.04	7.64	6.64	-
Critical Hdwy Stg 1	-	-	-				-	5.64	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.64	5.64	-
Follow-up Hdwy	2.36	-	-				-	4.07	3.37	3.57	4.07	-
Pot Cap-1 Maneuver	-	-	-				0	735	962	874	735	0
Stage 1	-	-	-				0	765	-	-	-	0
Stage 2	-	-	-				0	-	-	895	765	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	735	962	832	735	-
Mov Cap-2 Maneuver	-	-	-				-	735	-	832	735	-
Stage 1	-	-	-				-	765	-	-	-	-
Stage 2	-	-	-				-	-	-	845	765	-

Approach	EB	NB	SB
HCM Control Delay, s		9.7	10
HCM LOS		A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	814	-	-	-	735
HCM Lane V/C Ratio	0.058	-	-	-	0.022
HCM Control Delay (s)	9.7	-	-	-	10
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.1

Intersection						
Int Delay, s/veh	1.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1	11	30	18	1
Future Vol, veh/h	1	1	11	30	18	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	1	1	13	37	22	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	86	23	23	0	-	0
Stage 1	23	-	-	-	-	-
Stage 2	63	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	913	1051	1586	-	-	-
Stage 1	997	-	-	-	-	-
Stage 2	957	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	906	1051	1586	-	-	-
Mov Cap-2 Maneuver	906	-	-	-	-	-
Stage 1	989	-	-	-	-	-
Stage 2	957	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1586	-	973	-	-
HCM Lane V/C Ratio	0.008	-	0.003	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	34	1	1	17
Future Vol, veh/h	1	0	34	1	1	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	4	4	4	4	4	4
Mvmt Flow	1	0	43	1	1	22

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	68	44	0	0	44	0
Stage 1	44	-	-	-	-	-
Stage 2	24	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.14	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.236	-
Pot Cap-1 Maneuver	932	1020	-	-	1552	-
Stage 1	973	-	-	-	-	-
Stage 2	993	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	931	1020	-	-	1552	-
Mov Cap-2 Maneuver	931	-	-	-	-	-
Stage 1	972	-	-	-	-	-
Stage 2	993	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	931	1552	-
HCM Lane V/C Ratio	-	-	0.001	0.001	-
HCM Control Delay (s)	-	-	8.9	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Future Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	12	12	12	10	10	10	10	10	10
Mvmt Flow	0	0	0	4	183	0	8	2	0	0	2	0

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	101	191	-	-	191	92
Stage 1	-	-	-	0	0	-	-	191	-
Stage 2	-	-	-	101	191	-	-	0	-
Critical Hdwy	4.34	-	-	7.7	6.7	-	-	6.7	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.7	-
Critical Hdwy Stg 2	-	-	-	6.7	5.7	-	-	-	-
Follow-up Hdwy	2.32	-	-	3.6	4.1	-	-	4.1	3.4
Pot Cap-1 Maneuver	-	-	-	847	685	0	0	685	922
Stage 1	-	-	-	-	-	0	0	722	-
Stage 2	-	-	-	871	722	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	845	685	-	-	685	922
Mov Cap-2 Maneuver	-	-	-	845	685	-	-	685	-
Stage 1	-	-	-	-	-	-	-	722	-
Stage 2	-	-	-	868	722	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		9.5	10.3
HCM LOS		A	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	803	-	-	-	685
HCM Lane V/C Ratio	0.012	-	-	-	0.003
HCM Control Delay (s)	9.5	-	-	-	10.3
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Future Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	92	92	92	88	88	88	88	88	88
Heavy Vehicles, %	17	17	17	2	2	2	10	10	10	10	10	10
Mvmt Flow	2	147	5	0	0	0	0	7	5	1	6	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	151	74	81	151	-
Stage 1	-	-	-				-	151	-	0	0	-
Stage 2	-	-	-				-	0	-	81	151	-
Critical Hdwy	4.44	-	-				-	6.7	7.1	7.7	6.7	-
Critical Hdwy Stg 1	-	-	-				-	5.7	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.7	5.7	-
Follow-up Hdwy	2.37	-	-				-	4.1	3.4	3.6	4.1	-
Pot Cap-1 Maneuver	-	-	-				0	722	947	875	722	0
Stage 1	-	-	-				0	752	-	-	-	0
Stage 2	-	-	-				0	-	-	895	752	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	722	947	865	722	-
Mov Cap-2 Maneuver	-	-	-				-	722	-	865	722	-
Stage 1	-	-	-				-	752	-	-	-	-
Stage 2	-	-	-				-	-	-	883	752	-

Approach	EB	NB	SB
HCM Control Delay, s		9.6	9.9
HCM LOS		A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	798	-	-	-	742
HCM Lane V/C Ratio	0.014	-	-	-	0.009
HCM Control Delay (s)	9.6	-	-	-	9.9
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	0	1	6	12	0
Future Vol, veh/h	2	0	1	6	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	3	3	23	23	23	23
Mvmt Flow	3	0	1	8	15	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	25	15	15	0	-	0
Stage 1	15	-	-	-	-	-
Stage 2	10	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.33	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.407	-	-	-
Pot Cap-1 Maneuver	988	1062	1476	-	-	-
Stage 1	1005	-	-	-	-	-
Stage 2	1010	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	987	1062	1476	-	-	-
Mov Cap-2 Maneuver	987	-	-	-	-	-
Stage 1	1004	-	-	-	-	-
Stage 2	1010	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	1.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1476	-	987	-	-
HCM Lane V/C Ratio	0.001	-	0.003	-	-
HCM Control Delay (s)	7.4	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	7	0	2	11
Future Vol, veh/h	0	0	7	0	2	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	63	63	63	63
Heavy Vehicles, %	4	4	35	35	35	35
Mvmt Flow	0	0	11	0	3	17

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	34	11	0	0	11	0
Stage 1	11	-	-	-	-	-
Stage 2	23	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.45	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.515	-
Pot Cap-1 Maneuver	974	1064	-	-	1418	-
Stage 1	1007	-	-	-	-	-
Stage 2	994	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	972	1064	-	-	1418	-
Mov Cap-2 Maneuver	972	-	-	-	-	-
Stage 1	1005	-	-	-	-	-
Stage 2	994	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1418	-
HCM Lane V/C Ratio	-	-	-	0.002	-
HCM Control Delay (s)	-	-	0	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection												
Int Delay, s/veh	1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Future Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	21	21	21	11	11	11	14	14	14
Mvmt Flow	0	0	0	11	233	0	13	7	0	0	4	3

Major/Minor				Major2			Minor1			Minor2		
Conflicting Flow All				0	0	0	141	255	-	-	255	117
Stage 1				-	-	-	0	0	-	-	255	-
Stage 2				-	-	-	141	255	-	-	0	-
Critical Hdwy				4.52	-	-	7.72	6.72	-	-	6.78	7.18
Critical Hdwy Stg 1				-	-	-	-	-	-	-	5.78	-
Critical Hdwy Stg 2				-	-	-	6.72	5.72	-	-	-	-
Follow-up Hdwy				2.41	-	-	3.61	4.11	-	-	4.14	3.44
Pot Cap-1 Maneuver				-	-	-	790	627	0	0	621	876
Stage 1				-	-	-	-	-	0	0	666	-
Stage 2				-	-	-	822	673	0	0	-	-
Platoon blocked, %					-	-						
Mov Cap-1 Maneuver				-	-	-	783	627	-	-	621	876
Mov Cap-2 Maneuver				-	-	-	783	627	-	-	621	-
Stage 1				-	-	-	-	-	-	-	666	-
Stage 2				-	-	-	813	673	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		10.1	10.1
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	723	-	-	-	710
HCM Lane V/C Ratio	0.028	-	-	-	0.011
HCM Control Delay (s)	10.1	-	-	-	10.1
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0

Intersection												
Int Delay, s/veh	1.2											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Future Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	92	92	92	90	90	90	90	90	90
Heavy Vehicles, %	6	6	6	2	2	2	4	4	4	4	4	4
Mvmt Flow	1	316	24	0	0	0	0	18	11	0	16	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	318	158	169	318	-
Stage 1	-	-	-				-	318	-	0	0	-
Stage 2	-	-	-				-	0	-	169	318	-
Critical Hdwy	4.22	-	-				-	6.58	6.98	7.58	6.58	-
Critical Hdwy Stg 1	-	-	-				-	5.58	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.58	5.58	-
Follow-up Hdwy	2.26	-	-				-	4.04	3.34	3.54	4.04	-
Pot Cap-1 Maneuver	-	-	-				0	592	853	773	592	0
Stage 1	-	-	-				0	647	-	-	-	0
Stage 2	-	-	-				0	-	-	810	647	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	592	853	745	592	-
Mov Cap-2 Maneuver	-	-	-				-	592	-	745	592	-
Stage 1	-	-	-				-	647	-	-	-	-
Stage 2	-	-	-				-	-	-	777	647	-

Approach	EB	NB	SB
HCM Control Delay, s		10.6	11.2
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	671	-	-	-	592
HCM Lane V/C Ratio	0.043	-	-	-	0.026
HCM Control Delay (s)	10.6	-	-	-	11.2
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

Intersection						
Int Delay, s/veh	0.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	3	2	23	34	2
Future Vol, veh/h	1	3	2	23	34	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	1	3	2	24	35	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	64	36	37	0	-	0
Stage 1	36	-	-	-	-	-
Stage 2	28	-	-	-	-	-
Critical Hdwy	6.46	6.26	4.16	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.354	2.254	-	-	-
Pot Cap-1 Maneuver	932	1025	1548	-	-	-
Stage 1	976	-	-	-	-	-
Stage 2	984	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	931	1025	1548	-	-	-
Mov Cap-2 Maneuver	931	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	984	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1548	-	1000	-	-
HCM Lane V/C Ratio	0.001	-	0.004	-	-
HCM Control Delay (s)	7.3	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	25	0	2	36
Future Vol, veh/h	0	0	25	0	2	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	0	0	30	0	2	43

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	77	30	0	0	30	0
Stage 1	30	-	-	-	-	-
Stage 2	47	-	-	-	-	-
Critical Hdwy	6.45	6.25	-	-	4.15	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.345	-	-	2.245	-
Pot Cap-1 Maneuver	919	1036	-	-	1564	-
Stage 1	985	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	918	1036	-	-	1564	-
Mov Cap-2 Maneuver	918	-	-	-	-	-
Stage 1	984	-	-	-	-	-
Stage 2	968	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1564	-
HCM Lane V/C Ratio	-	-	-	0.002	-
HCM Control Delay (s)	-	-	0	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection												
Int Delay, s/veh	1.2											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Future Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	10	10	10	12	12	12	12	12	12
Mvmt Flow	0	0	0	24	430	0	37	4	0	0	0	12

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	263	478	-	-	478	215
Stage 1	-	-	-	0	0	-	-	478	-
Stage 2	-	-	-	263	478	-	-	0	-
Critical Hdwy	4.3	-	-	7.74	6.74	-	-	6.74	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.74	-
Critical Hdwy Stg 2	-	-	-	6.74	5.74	-	-	-	-
Follow-up Hdwy	2.3	-	-	3.62	4.12	-	-	4.12	3.42
Pot Cap-1 Maneuver	-	-	-	643	464	0	0	464	760
Stage 1	-	-	-	-	-	0	0	529	-
Stage 2	-	-	-	692	529	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	633	464	-	-	464	760
Mov Cap-2 Maneuver	-	-	-	633	464	-	-	464	-
Stage 1	-	-	-	-	-	-	-	529	-
Stage 2	-	-	-	681	529	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		11.3	9.8
HCM LOS		B	A

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	609	-	-	-	760
HCM Lane V/C Ratio	0.068	-	-	-	0.016
HCM Control Delay (s)	11.3	-	-	-	9.8
HCM Lane LOS	B	-	-	-	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Future Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	92	92	92	94	94	94	94	94	94
Heavy Vehicles, %	16	16	16	2	2	2	7	7	7	7	7	7
Mvmt Flow	2	159	12	0	0	0	0	31	22	0	18	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	163	80	99	163	-
Stage 1	-	-	-				-	163	-	0	0	-
Stage 2	-	-	-				-	0	-	99	163	-
Critical Hdwy	4.42	-	-				-	6.64	7.04	7.64	6.64	-
Critical Hdwy Stg 1	-	-	-				-	5.64	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.64	5.64	-
Follow-up Hdwy	2.36	-	-				-	4.07	3.37	3.57	4.07	-
Pot Cap-1 Maneuver	-	-	-				0	717	948	858	717	0
Stage 1	-	-	-				0	750	-	-	-	0
Stage 2	-	-	-				0	-	-	882	750	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	717	948	811	717	-
Mov Cap-2 Maneuver	-	-	-				-	717	-	811	717	-
Stage 1	-	-	-				-	750	-	-	-	-
Stage 2	-	-	-				-	-	-	826	750	-

Approach	EB	NB	SB
HCM Control Delay, s		9.8	10.2
HCM LOS		A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	796	-	-	-	717
HCM Lane V/C Ratio	0.066	-	-	-	0.025
HCM Control Delay (s)	9.8	-	-	-	10.2
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.1

Intersection						
Int Delay, s/veh	1.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1	11	30	18	1
Future Vol, veh/h	1	1	11	30	18	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	1	1	15	41	25	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	97	26	26	0	-	0
Stage 1	26	-	-	-	-	-
Stage 2	71	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	900	1047	1582	-	-	-
Stage 1	994	-	-	-	-	-
Stage 2	949	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	891	1047	1582	-	-	-
Mov Cap-2 Maneuver	891	-	-	-	-	-
Stage 1	984	-	-	-	-	-
Stage 2	949	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1582	-	963	-	-
HCM Lane V/C Ratio	0.01	-	0.003	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	34	1	1	17
Future Vol, veh/h	1	0	34	1	1	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	4	4	4	4	4	4
Mvmt Flow	1	0	49	1	1	24

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	76	50	0	0	50	0
Stage 1	50	-	-	-	-	-
Stage 2	26	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.14	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.236	-
Pot Cap-1 Maneuver	922	1013	-	-	1544	-
Stage 1	967	-	-	-	-	-
Stage 2	991	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	921	1013	-	-	1544	-
Mov Cap-2 Maneuver	921	-	-	-	-	-
Stage 1	966	-	-	-	-	-
Stage 2	991	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	921	1544	-
HCM Lane V/C Ratio	-	-	0.002	0.001	-
HCM Control Delay (s)	-	-	8.9	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Future Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	12	12	12	10	10	10	10	10	10
Mvmt Flow	0	0	0	5	207	0	9	3	0	0	3	0

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	115	217	-	-	217	104
Stage 1	-	-	-	0	0	-	-	217	-
Stage 2	-	-	-	115	217	-	-	0	-
Critical Hdwy	4.34	-	-	7.7	6.7	-	-	6.7	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.7	-
Critical Hdwy Stg 2	-	-	-	6.7	5.7	-	-	-	-
Follow-up Hdwy	2.32	-	-	3.6	4.1	-	-	4.1	3.4
Pot Cap-1 Maneuver	-	-	-	828	662	0	0	662	906
Stage 1	-	-	-	-	-	0	0	703	-
Stage 2	-	-	-	855	703	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	826	662	-	-	662	906
Mov Cap-2 Maneuver	-	-	-	826	662	-	-	662	-
Stage 1	-	-	-	-	-	-	-	703	-
Stage 2	-	-	-	852	703	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		9.7	10.5
HCM LOS		A	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	783	-	-	-	662
HCM Lane V/C Ratio	0.014	-	-	-	0.004
HCM Control Delay (s)	9.7	-	-	-	10.5
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection												
Int Delay, s/veh	1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Future Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	92	92	92	88	88	88	88	88	88
Heavy Vehicles, %	17	17	17	2	2	2	10	10	10	10	10	10
Mvmt Flow	3	166	5	0	0	0	0	8	5	1	6	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	172	83	93	172	-
Stage 1	-	-	-				-	172	-	0	0	-
Stage 2	-	-	-				-	0	-	93	172	-
Critical Hdwy	4.44	-	-				-	6.7	7.1	7.7	6.7	-
Critical Hdwy Stg 1	-	-	-				-	5.7	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.7	5.7	-
Follow-up Hdwy	2.37	-	-				-	4.1	3.4	3.6	4.1	-
Pot Cap-1 Maneuver	-	-	-				0	702	935	858	702	0
Stage 1	-	-	-				0	736	-	-	-	0
Stage 2	-	-	-				0	-	-	881	736	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	702	935	846	702	-
Mov Cap-2 Maneuver	-	-	-				-	702	-	846	702	-
Stage 1	-	-	-				-	736	-	-	-	-
Stage 2	-	-	-				-	-	-	867	736	-

Approach	EB						NB			SB		
HCM Control Delay, s							9.7			10		
HCM LOS							A			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	780	-	-	-	722
HCM Lane V/C Ratio	0.016	-	-	-	0.011
HCM Control Delay (s)	9.7	-	-	-	10
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0

Intersection						
Int Delay, s/veh	1.2					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	0	1	6	12	0
Future Vol, veh/h	2	0	1	6	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	3	3	23	23	23	23
Mvmt Flow	3	0	1	9	17	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	28	17	17	0	-	0
Stage 1	17	-	-	-	-	-
Stage 2	11	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.33	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.407	-	-	-
Pot Cap-1 Maneuver	984	1059	1474	-	-	-
Stage 1	1003	-	-	-	-	-
Stage 2	1009	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	983	1059	1474	-	-	-
Mov Cap-2 Maneuver	983	-	-	-	-	-
Stage 1	1002	-	-	-	-	-
Stage 2	1009	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	1.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1474	-	983	-	-
HCM Lane V/C Ratio	0.001	-	0.003	-	-
HCM Control Delay (s)	7.4	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	7	0	2	11
Future Vol, veh/h	0	0	7	0	2	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	63	63	63	63
Heavy Vehicles, %	4	4	35	35	35	35
Mvmt Flow	0	0	13	0	4	20

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	41	13	0	0	13	0
Stage 1	13	-	-	-	-	-
Stage 2	28	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.45	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.515	-
Pot Cap-1 Maneuver	965	1061	-	-	1415	-
Stage 1	1005	-	-	-	-	-
Stage 2	989	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	962	1061	-	-	1415	-
Mov Cap-2 Maneuver	962	-	-	-	-	-
Stage 1	1002	-	-	-	-	-
Stage 2	989	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1415	-
HCM Lane V/C Ratio	-	-	-	0.003	-
HCM Control Delay (s)	-	-	0	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection												
Int Delay, s/veh	1.1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Future Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	21	21	21	11	11	11	14	14	14
Mvmt Flow	0	0	0	13	264	0	15	8	0	0	5	4

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	161	290	-	-	290	132
Stage 1	-	-	-	0	0	-	-	290	-
Stage 2	-	-	-	161	290	-	-	0	-
Critical Hdwy	4.52	-	-	7.72	6.72	-	-	6.78	7.18
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.78	-
Critical Hdwy Stg 2	-	-	-	6.72	5.72	-	-	-	-
Follow-up Hdwy	2.41	-	-	3.61	4.11	-	-	4.14	3.44
Pot Cap-1 Maneuver	-	-	-	765	599	0	0	592	856
Stage 1	-	-	-	-	-	0	0	642	-
Stage 2	-	-	-	800	649	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	757	599	-	-	592	856
Mov Cap-2 Maneuver	-	-	-	757	599	-	-	592	-
Stage 1	-	-	-	-	-	-	-	642	-
Stage 2	-	-	-	790	649	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		10.3	10.3
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	696	-	-	-	682
HCM Lane V/C Ratio	0.032	-	-	-	0.013
HCM Control Delay (s)	10.3	-	-	-	10.3
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Future Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	92	92	92	90	90	90	90	90	90
Heavy Vehicles, %	6	6	6	2	2	2	4	4	4	4	4	4
Mvmt Flow	1	357	28	0	0	0	0	20	13	0	18	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	359	179	191	359	-
Stage 1	-	-	-				-	359	-	0	0	-
Stage 2	-	-	-				-	0	-	191	359	-
Critical Hdwy	4.22	-	-				-	6.58	6.98	7.58	6.58	-
Critical Hdwy Stg 1	-	-	-				-	5.58	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.58	5.58	-
Follow-up Hdwy	2.26	-	-				-	4.04	3.34	3.54	4.04	-
Pot Cap-1 Maneuver	-	-	-				0	562	827	746	562	0
Stage 1	-	-	-				0	621	-	-	-	0
Stage 2	-	-	-				0	-	-	787	621	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	562	827	715	562	-
Mov Cap-2 Maneuver	-	-	-				-	562	-	715	562	-
Stage 1	-	-	-				-	621	-	-	-	-
Stage 2	-	-	-				-	-	-	750	621	-

Approach	EB	NB	SB
HCM Control Delay, s		10.9	11.6
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	641	-	-	-	562
HCM Lane V/C Ratio	0.051	-	-	-	0.031
HCM Control Delay (s)	10.9	-	-	-	11.6
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.1

Intersection						
Int Delay, s/veh	0.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	3	2	23	34	2
Future Vol, veh/h	1	3	2	23	34	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	1	4	2	27	40	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	72	41	42	0	-	0
Stage 1	41	-	-	-	-	-
Stage 2	31	-	-	-	-	-
Critical Hdwy	6.46	6.26	4.16	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.354	2.254	-	-	-
Pot Cap-1 Maneuver	922	1019	1542	-	-	-
Stage 1	971	-	-	-	-	-
Stage 2	981	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	921	1019	1542	-	-	-
Mov Cap-2 Maneuver	921	-	-	-	-	-
Stage 1	970	-	-	-	-	-
Stage 2	981	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1542	-	993	-	-
HCM Lane V/C Ratio	0.002	-	0.005	-	-
HCM Control Delay (s)	7.3	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	25	0	2	36
Future Vol, veh/h	0	0	25	0	2	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	0	0	34	0	3	48

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	88	34	0	0	34	0
Stage 1	34	-	-	-	-	-
Stage 2	54	-	-	-	-	-
Critical Hdwy	6.45	6.25	-	-	4.15	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.345	-	-	2.245	-
Pot Cap-1 Maneuver	906	1031	-	-	1558	-
Stage 1	981	-	-	-	-	-
Stage 2	961	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	904	1031	-	-	1558	-
Mov Cap-2 Maneuver	904	-	-	-	-	-
Stage 1	979	-	-	-	-	-
Stage 2	961	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1558	-
HCM Lane V/C Ratio	-	-	-	0.002	-
HCM Control Delay (s)	-	-	0	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection												
Int Delay, s/veh	1.7											
Movement	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**
Lane Configurations												
Traffic Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Future Vol, veh/h	0	0	0	16	289	0	25	3	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	10	10	10	12	12	12	12	12	12
Mvmt Flow	0	0	0	47	856	0	74	9	0	0	0	24

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	522	950	-	-	950	428
Stage 1	-	-	-	0	0	-	-	950	-
Stage 2	-	-	-	522	950	-	-	0	-
Critical Hdwy	4.3	-	-	7.74	6.74	-	-	6.74	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.74	-
Critical Hdwy Stg 2	-	-	-	6.74	5.74	-	-	-	-
Follow-up Hdwy	2.3	-	-	3.62	4.12	-	-	4.12	3.42
Pot Cap-1 Maneuver	-	-	-	416	242	0	0	242	548
Stage 1	-	-	-	-	-	0	0	315	-
Stage 2	-	-	-	481	315	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	398	242	-	-	242	548
Mov Cap-2 Maneuver	-	-	-	398	242	-	-	242	-
Stage 1	-	-	-	-	-	-	-	315	-
Stage 2	-	-	-	460	315	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		17.4	11.9
HCM LOS		C	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	372	-	-	-	548
HCM Lane V/C Ratio	0.223	-	-	-	0.043
HCM Control Delay (s)	17.4	-	-	-	11.9
HCM Lane LOS	C	-	-	-	B
HCM 95th %tile Q(veh)	0.8	-	-	-	0.1

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Future Vol, veh/h	2	132	10	0	0	0	0	26	18	0	15	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	92	92	92	94	94	94	94	94	94
Heavy Vehicles, %	16	16	16	2	2	2	7	7	7	7	7	7
Mvmt Flow	5	316	24	0	0	0	0	62	43	0	36	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	326	158	199	326	-
Stage 1	-	-	-				-	326	-	0	0	-
Stage 2	-	-	-				-	0	-	199	326	-
Critical Hdwy	4.42	-	-				-	6.64	7.04	7.64	6.64	-
Critical Hdwy Stg 1	-	-	-				-	5.64	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.64	5.64	-
Follow-up Hdwy	2.36	-	-				-	4.07	3.37	3.57	4.07	-
Pot Cap-1 Maneuver	-	-	-				0	580	844	728	580	0
Stage 1	-	-	-				0	635	-	-	-	0
Stage 2	-	-	-				0	-	-	770	635	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	580	844	634	580	-
Mov Cap-2 Maneuver	-	-	-				-	580	-	634	580	-
Stage 1	-	-	-				-	635	-	-	-	-
Stage 2	-	-	-				-	-	-	659	635	-

Approach	EB	NB	SB
HCM Control Delay, s		11.4	11.6
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	665	-	-	-	580
HCM Lane V/C Ratio	0.158	-	-	-	0.062
HCM Control Delay (s)	11.4	-	-	-	11.6
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.6	-	-	-	0.2

Intersection						
Int Delay, s/veh	1.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	1	11	30	18	1
Future Vol, veh/h	1	1	11	30	18	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	3	3	30	82	49	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	193	51	52	0	-	0
Stage 1	51	-	-	-	-	-
Stage 2	142	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.227	-	-	-
Pot Cap-1 Maneuver	794	1014	1548	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	883	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	778	1014	1548	-	-	-
Mov Cap-2 Maneuver	778	-	-	-	-	-
Stage 1	950	-	-	-	-	-
Stage 2	883	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1548	-	880	-	-
HCM Lane V/C Ratio	0.019	-	0.006	-	-
HCM Control Delay (s)	7.4	0	9.1	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0	-	-

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	34	1	1	17
Future Vol, veh/h	1	0	34	1	1	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	4	4	4	4	4	4
Mvmt Flow	3	0	97	3	3	48

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	153	99	0	0	100	0
Stage 1	99	-	-	-	-	-
Stage 2	54	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.14	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.236	-
Pot Cap-1 Maneuver	834	951	-	-	1480	-
Stage 1	920	-	-	-	-	-
Stage 2	963	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	832	951	-	-	1480	-
Mov Cap-2 Maneuver	832	-	-	-	-	-
Stage 1	918	-	-	-	-	-
Stage 2	963	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	832	1480	-
HCM Lane V/C Ratio	-	-	0.003	0.002	-
HCM Control Delay (s)	-	-	9.3	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Future Vol, veh/h	0	0	0	4	165	0	7	2	0	0	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	12	12	12	10	10	10	10	10	10
Mvmt Flow	0	0	0	10	413	0	18	5	0	0	5	0

Major/Minor				Major2			Minor1			Minor2		
Conflicting Flow All				0	0	0	229	433	-	-	433	207
Stage 1				-	-	-	0	0	-	-	433	-
Stage 2				-	-	-	229	433	-	-	0	-
Critical Hdwy				4.34	-	-	7.7	6.7	-	-	6.7	7.1
Critical Hdwy Stg 1				-	-	-	-	-	-	-	5.7	-
Critical Hdwy Stg 2				-	-	-	6.7	5.7	-	-	-	-
Follow-up Hdwy				2.32	-	-	3.6	4.1	-	-	4.1	3.4
Pot Cap-1 Maneuver				-	-	-	686	497	0	0	497	775
Stage 1				-	-	-	-	-	0	0	560	-
Stage 2				-	-	-	731	560	0	0	-	-
Platoon blocked, %					-	-						
Mov Cap-1 Maneuver				-	-	-	681	497	-	-	497	775
Mov Cap-2 Maneuver				-	-	-	681	497	-	-	497	-
Stage 1				-	-	-	-	-	-	-	560	-
Stage 2				-	-	-	724	560	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		10.9	12.3
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	629	-	-	-	497
HCM Lane V/C Ratio	0.036	-	-	-	0.01
HCM Control Delay (s)	10.9	-	-	-	12.3
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Future Vol, veh/h	2	129	4	0	0	0	0	6	4	1	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	92	92	92	88	88	88	88	88	88
Heavy Vehicles, %	17	17	17	2	2	2	10	10	10	10	10	10
Mvmt Flow	5	330	10	0	0	0	0	15	10	3	13	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	340	165	183	340	-
Stage 1	-	-	-				-	340	-	0	0	-
Stage 2	-	-	-				-	0	-	183	340	-
Critical Hdwy	4.44	-	-				-	6.7	7.1	7.7	6.7	-
Critical Hdwy Stg 1	-	-	-				-	5.7	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.7	5.7	-
Follow-up Hdwy	2.37	-	-				-	4.1	3.4	3.6	4.1	-
Pot Cap-1 Maneuver	-	-	-				0	562	826	740	562	0
Stage 1	-	-	-				0	618	-	-	-	0
Stage 2	-	-	-				0	-	-	778	618	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	562	826	716	562	-
Mov Cap-2 Maneuver	-	-	-				-	562	-	716	562	-
Stage 1	-	-	-				-	618	-	-	-	-
Stage 2	-	-	-				-	-	-	749	618	-

Approach	EB	NB	SB
HCM Control Delay, s		10.8	11.3
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	644	-	-	-	583
HCM Lane V/C Ratio	0.04	-	-	-	0.026
HCM Control Delay (s)	10.8	-	-	-	11.3
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

Intersection						
Int Delay, s/veh	1.2					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	0	1	6	12	0
Future Vol, veh/h	2	0	1	6	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	3	3	23	23	23	23
Mvmt Flow	6	0	3	17	34	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	57	34	34	0	-	0
Stage 1	34	-	-	-	-	-
Stage 2	23	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.33	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.407	-	-	-
Pot Cap-1 Maneuver	948	1036	1452	-	-	-
Stage 1	986	-	-	-	-	-
Stage 2	997	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	946	1036	1452	-	-	-
Mov Cap-2 Maneuver	946	-	-	-	-	-
Stage 1	984	-	-	-	-	-
Stage 2	997	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	1.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1452	-	946	-	-
HCM Lane V/C Ratio	0.002	-	0.006	-	-
HCM Control Delay (s)	7.5	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	7	0	2	11
Future Vol, veh/h	0	0	7	0	2	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	63	63	63	63
Heavy Vehicles, %	4	4	35	35	35	35
Mvmt Flow	0	0	25	0	7	39

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	78	25	0	0	25	0
Stage 1	25	-	-	-	-	-
Stage 2	53	-	-	-	-	-
Critical Hdwy	6.44	6.24	-	-	4.45	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	-	-	2.515	-
Pot Cap-1 Maneuver	920	1045	-	-	1400	-
Stage 1	992	-	-	-	-	-
Stage 2	964	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	915	1045	-	-	1400	-
Mov Cap-2 Maneuver	915	-	-	-	-	-
Stage 1	987	-	-	-	-	-
Stage 2	964	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1400	-
HCM Lane V/C Ratio	-	-	-	0.005	-
HCM Control Delay (s)	-	-	0	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Future Vol, veh/h	0	0	0	10	210	0	12	6	0	0	4	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	21	21	21	11	11	11	14	14	14
Mvmt Flow	0	0	0	25	525	0	30	15	0	0	10	8

Major/Minor				Major2			Minor1			Minor2		
Conflicting Flow All				0	0	0	318	575	-	-	575	263
Stage 1				-	-	-	0	0	-	-	575	-
Stage 2				-	-	-	318	575	-	-	0	-
Critical Hdwy				4.52	-	-	7.72	6.72	-	-	6.78	7.18
Critical Hdwy Stg 1				-	-	-	-	-	-	-	5.78	-
Critical Hdwy Stg 2				-	-	-	6.72	5.72	-	-	-	-
Follow-up Hdwy				2.41	-	-	3.61	4.11	-	-	4.14	3.44
Pot Cap-1 Maneuver				-	-	-	589	408	0	0	402	700
Stage 1				-	-	-	-	-	0	0	472	-
Stage 2				-	-	-	643	479	0	0	-	-
Platoon blocked, %					-	-						
Mov Cap-1 Maneuver				-	-	-	572	408	-	-	402	700
Mov Cap-2 Maneuver				-	-	-	572	408	-	-	402	-
Stage 1				-	-	-	-	-	-	-	472	-
Stage 2				-	-	-	623	479	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		12.8	12.6
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	504	-	-	-	492
HCM Lane V/C Ratio	0.089	-	-	-	0.036
HCM Control Delay (s)	12.8	-	-	-	12.6
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Future Vol, veh/h	1	284	22	0	0	0	0	16	10	0	14	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	92	92	92	90	90	90	90	90	90
Heavy Vehicles, %	6	6	6	2	2	2	4	4	4	4	4	4
Mvmt Flow	3	710	55	0	0	0	0	40	25	0	35	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	716	355	381	716	-
Stage 1	-	-	-				-	716	-	0	0	-
Stage 2	-	-	-				-	0	-	381	716	-
Critical Hdwy	4.22	-	-				-	6.58	6.98	7.58	6.58	-
Critical Hdwy Stg 1	-	-	-				-	5.58	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.58	5.58	-
Follow-up Hdwy	2.26	-	-				-	4.04	3.34	3.54	4.04	-
Pot Cap-1 Maneuver	-	-	-				0	350	636	547	350	0
Stage 1	-	-	-				0	427	-	-	-	0
Stage 2	-	-	-				0	-	-	608	427	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	350	636	480	350	-
Mov Cap-2 Maneuver	-	-	-				-	350	-	480	350	-
Stage 1	-	-	-				-	427	-	-	-	-
Stage 2	-	-	-				-	-	-	529	427	-

Approach	EB	NB	SB
HCM Control Delay, s		15.1	16.4
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	423	-	-	-	350
HCM Lane V/C Ratio	0.154	-	-	-	0.1
HCM Control Delay (s)	15.1	-	-	-	16.4
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	0.5	-	-	-	0.3

Intersection						
Int Delay, s/veh	0.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	3	2	23	34	2
Future Vol, veh/h	1	3	2	23	34	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	2	7	5	54	80	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	147	83	85	0	-	0
Stage 1	83	-	-	-	-	-
Stage 2	64	-	-	-	-	-
Critical Hdwy	6.46	6.26	4.16	-	-	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.354	2.254	-	-	-
Pot Cap-1 Maneuver	836	965	1487	-	-	-
Stage 1	930	-	-	-	-	-
Stage 2	949	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	833	965	1487	-	-	-
Mov Cap-2 Maneuver	833	-	-	-	-	-
Stage 1	927	-	-	-	-	-
Stage 2	949	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1487	-	928	-	-
HCM Lane V/C Ratio	0.003	-	0.01	-	-
HCM Control Delay (s)	7.4	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	25	0	2	36
Future Vol, veh/h	0	0	25	0	2	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	5	5	5	5	5	5
Mvmt Flow	0	0	67	0	5	96

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	173	67	0	0	67	0
Stage 1	67	-	-	-	-	-
Stage 2	106	-	-	-	-	-
Critical Hdwy	6.45	6.25	-	-	4.15	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.345	-	-	2.245	-
Pot Cap-1 Maneuver	810	988	-	-	1516	-
Stage 1	948	-	-	-	-	-
Stage 2	911	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	808	988	-	-	1516	-
Mov Cap-2 Maneuver	808	-	-	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	911	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	1516	-
HCM Lane V/C Ratio	-	-	-	0.004	-
HCM Control Delay (s)	-	-	0	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	26	327	0	44	5	0	0	2	9
Future Vol, veh/h	0	0	0	26	327	0	44	5	0	0	2	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	69	76	76	69	69	76	76	69	76
Heavy Vehicles, %	2	2	2	10	10	10	30	30	30	30	30	30
Mvmt Flow	0	0	0	38	430	0	64	7	0	0	3	12

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	293	506	-	-	506	215
Stage 1	-	-	-	0	0	-	-	506	-
Stage 2	-	-	-	293	506	-	-	0	-
Critical Hdwy	4.3	-	-	8.1	7.1	-	-	7.1	7.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.1	-
Critical Hdwy Stg 2	-	-	-	7.1	6.1	-	-	-	-
Follow-up Hdwy	2.3	-	-	3.8	4.3	-	-	4.3	3.6
Pot Cap-1 Maneuver	-	-	-	570	411	0	0	411	710
Stage 1	-	-	-	-	-	0	0	473	-
Stage 2	-	-	-	618	473	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	557	411	-	-	411	710
Mov Cap-2 Maneuver	-	-	-	557	411	-	-	411	-
Stage 1	-	-	-	-	-	-	-	473	-
Stage 2	-	-	-	604	473	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		12.7	10.9
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	538	-	-	-	621
HCM Lane V/C Ratio	0.132	-	-	-	0.024
HCM Control Delay (s)	12.7	-	-	-	10.9
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.5	-	-	-	0.1

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	149	35	0	0	0	0	45	25	0	27	0
Future Vol, veh/h	2	149	35	0	0	0	0	45	25	0	27	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	69	92	92	92	94	69	69	94	69	94
Heavy Vehicles, %	20	20	20	2	2	2	30	30	30	30	30	30
Mvmt Flow	2	159	51	0	0	0	0	65	36	0	39	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	163	80	116	163	-
Stage 1	-	-	-				-	163	-	0	0	-
Stage 2	-	-	-				-	0	-	116	163	-
Critical Hdwy	4.5	-	-				-	7.1	7.5	8.1	7.1	-
Critical Hdwy Stg 1	-	-	-				-	6.1	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	7.1	6.1	-
Follow-up Hdwy	2.4	-	-				-	4.3	3.6	3.8	4.3	-
Pot Cap-1 Maneuver	-	-	-				0	668	881	775	668	0
Stage 1	-	-	-				0	699	-	-	-	0
Stage 2	-	-	-				0	-	-	801	699	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	668	881	687	668	-
Mov Cap-2 Maneuver	-	-	-				-	668	-	687	668	-
Stage 1	-	-	-				-	699	-	-	-	-
Stage 2	-	-	-				-	-	-	696	699	-

Approach	EB	NB	SB
HCM Control Delay, s		10.7	10.7
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	731	-	-	-	668
HCM Lane V/C Ratio	0.139	-	-	-	0.059
HCM Control Delay (s)	10.7	-	-	-	10.7
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.5	-	-	-	0.2

Intersection						
Int Delay, s/veh	1.4					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	1	12	39	23	2
Future Vol, veh/h	2	1	12	39	23	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	33	33	15	15	15	15
Mvmt Flow	2	1	15	48	28	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	107	29	30	0	-	0
Stage 1	29	-	-	-	-	-
Stage 2	78	-	-	-	-	-
Critical Hdwy	6.73	6.53	4.25	-	-	-
Critical Hdwy Stg 1	5.73	-	-	-	-	-
Critical Hdwy Stg 2	5.73	-	-	-	-	-
Follow-up Hdwy	3.797	3.597	2.335	-	-	-
Pot Cap-1 Maneuver	821	963	1503	-	-	-
Stage 1	919	-	-	-	-	-
Stage 2	872	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	813	963	1503	-	-	-
Mov Cap-2 Maneuver	813	-	-	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	872	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	1.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1503	-	858	-	-
HCM Lane V/C Ratio	0.01	-	0.004	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	1	42	1	2	21
Future Vol, veh/h	1	1	42	1	2	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	50	50	10	10	10	10
Mvmt Flow	1	1	53	1	3	27

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	87	54	0	0	54	0
Stage 1	54	-	-	-	-	-
Stage 2	33	-	-	-	-	-
Critical Hdwy	6.9	6.7	-	-	4.2	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	-	-	2.29	-
Pot Cap-1 Maneuver	809	893	-	-	1502	-
Stage 1	859	-	-	-	-	-
Stage 2	879	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	807	893	-	-	1502	-
Mov Cap-2 Maneuver	807	-	-	-	-	-
Stage 1	857	-	-	-	-	-
Stage 2	879	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	0.6
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	848	1502	-
HCM Lane V/C Ratio	-	-	0.003	0.002	-
HCM Control Delay (s)	-	-	9.3	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	4.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	21	49	6	34	28
Future Vol, veh/h	4	21	49	6	34	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	69	69	92
Heavy Vehicles, %	100	100	20	100	100	20
Mvmt Flow	6	30	53	9	49	30

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	186	58	0	0	62	0
Stage 1	58	-	-	-	-	-
Stage 2	128	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	5.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	3.1	-
Pot Cap-1 Maneuver	624	789	-	-	1092	-
Stage 1	764	-	-	-	-	-
Stage 2	704	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	595	789	-	-	1092	-
Mov Cap-2 Maneuver	595	-	-	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	704	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10	0	5.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	750	1092	-
HCM Lane V/C Ratio	-	-	0.048	0.045	-
HCM Control Delay (s)	-	-	10	8.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	18	186	0	37	5	0	0	7	0
Future Vol, veh/h	0	0	0	18	186	0	37	5	0	0	7	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	20	20	20	80	80	80	80	80	80
Mvmt Flow	0	0	0	20	207	0	41	6	0	0	8	0

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	148	247	-	-	247	104
Stage 1	-	-	-	0	0	-	-	247	-
Stage 2	-	-	-	148	247	-	-	0	-
Critical Hdwy	4.5	-	-	9.1	8.1	-	-	8.1	8.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	7.1	-
Critical Hdwy Stg 2	-	-	-	8.1	7.1	-	-	-	-
Follow-up Hdwy	2.4	-	-	4.3	4.8	-	-	4.8	4.1
Pot Cap-1 Maneuver	-	-	-	628	505	0	0	505	728
Stage 1	-	-	-	-	-	0	0	541	-
Stage 2	-	-	-	655	541	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	620	505	-	-	505	728
Mov Cap-2 Maneuver	-	-	-	620	505	-	-	505	-
Stage 1	-	-	-	-	-	-	-	541	-
Stage 2	-	-	-	646	541	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		11.5	12.2
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	604	-	-	-	505
HCM Lane V/C Ratio	0.077	-	-	-	0.015
HCM Control Delay (s)	11.5	-	-	-	12.2
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	146	44	0	0	0	0	39	15	1	25	0
Future Vol, veh/h	2	146	44	0	0	0	0	39	15	1	25	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	92	92	92	88	88	88	88	88	88
Heavy Vehicles, %	35	35	35	2	2	2	70	70	70	70	70	70
Mvmt Flow	2	166	50	0	0	0	0	44	17	1	28	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	170	83	109	170	-
Stage 1	-	-	-				-	170	-	0	0	-
Stage 2	-	-	-				-	0	-	109	170	-
Critical Hdwy	4.8	-	-				-	7.9	8.3	8.9	7.9	-
Critical Hdwy Stg 1	-	-	-				-	6.9	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	7.9	6.9	-
Follow-up Hdwy	2.55	-	-				-	4.7	4	4.2	4.7	-
Pot Cap-1 Maneuver	-	-	-				0	588	778	697	588	0
Stage 1	-	-	-				0	617	-	-	-	0
Stage 2	-	-	-				0	-	-	719	617	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	588	778	643	588	-
Mov Cap-2 Maneuver	-	-	-				-	588	-	643	588	-
Stage 1	-	-	-				-	617	-	-	-	-
Stage 2	-	-	-				-	-	-	653	617	-

Approach	EB	NB	SB
HCM Control Delay, s		11.3	11.4
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	631	-	-	-	590
HCM Lane V/C Ratio	0.097	-	-	-	0.05
HCM Control Delay (s)	11.3	-	-	-	11.4
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.2

Intersection						
Int Delay, s/veh	0.9					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	0	1	13	20	1
Future Vol, veh/h	3	0	1	13	20	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	50	50	60	60	60	60
Mvmt Flow	4	0	1	16	25	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	44	26	26	0	-	0
Stage 1	26	-	-	-	-	-
Stage 2	18	-	-	-	-	-
Critical Hdwy	6.9	6.7	4.7	-	-	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	2.74	-	-	-
Pot Cap-1 Maneuver	858	927	1283	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	894	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	857	927	1283	-	-	-
Mov Cap-2 Maneuver	857	-	-	-	-	-
Stage 1	885	-	-	-	-	-
Stage 2	894	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1283	-	857	-	-
HCM Lane V/C Ratio	0.001	-	0.004	-	-
HCM Control Delay (s)	7.8	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.9					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	14	0	3	17
Future Vol, veh/h	0	1	14	0	3	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	63	63	63	63
Heavy Vehicles, %	50	50	70	70	70	70
Mvmt Flow	0	2	22	0	5	27

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	59	22	0	0	22	0
Stage 1	22	-	-	-	-	-
Stage 2	37	-	-	-	-	-
Critical Hdwy	6.9	6.7	-	-	4.8	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	-	-	2.83	-
Pot Cap-1 Maneuver	841	932	-	-	1246	-
Stage 1	890	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	838	932	-	-	1246	-
Mov Cap-2 Maneuver	838	-	-	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	932	1246	-
HCM Lane V/C Ratio	-	-	0.002	0.004	-
HCM Control Delay (s)	-	-	8.9	7.9	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection						
Int Delay, s/veh	7.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	42	12	7	57	11
Future Vol, veh/h	7	42	12	7	57	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	92	90	90	92
Heavy Vehicles, %	100	100	50	100	100	50
Mvmt Flow	8	47	13	8	63	12

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	155	17	0	0	21	0
Stage 1	17	-	-	-	-	-
Stage 2	138	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	5.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	3.1	-
Pot Cap-1 Maneuver	653	837	-	-	1137	-
Stage 1	802	-	-	-	-	-
Stage 2	696	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	616	837	-	-	1137	-
Mov Cap-2 Maneuver	616	-	-	-	-	-
Stage 1	757	-	-	-	-	-
Stage 2	696	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.9	0	7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	796	1137	-
HCM Lane V/C Ratio	-	-	0.068	0.056	-
HCM Control Delay (s)	-	-	9.9	8.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.2	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	19	237	0	37	9	0	0	7	3
Future Vol, veh/h	0	0	0	19	237	0	37	9	0	0	7	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	25	25	25	60	60	60	20	20	20
Mvmt Flow	0	0	0	21	263	0	41	10	0	0	8	3

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	178	305	-	-	305	132
Stage 1	-	-	-	0	0	-	-	305	-
Stage 2	-	-	-	178	305	-	-	0	-
Critical Hdwy	4.6	-	-	8.7	7.7	-	-	6.9	7.3
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.9	-
Critical Hdwy Stg 2	-	-	-	7.7	6.7	-	-	-	-
Follow-up Hdwy	2.45	-	-	4.1	4.6	-	-	4.2	3.5
Pot Cap-1 Maneuver	-	-	-	631	492	0	0	568	839
Stage 1	-	-	-	-	-	0	0	618	-
Stage 2	-	-	-	663	536	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	622	492	-	-	568	839
Mov Cap-2 Maneuver	-	-	-	622	492	-	-	568	-
Stage 1	-	-	-	-	-	-	-	618	-
Stage 2	-	-	-	652	536	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		11.7	10.8
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	591	-	-	-	629
HCM Lane V/C Ratio	0.086	-	-	-	0.018
HCM Control Delay (s)	11.7	-	-	-	10.8
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.1

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	321	48	0	0	0	0	43	19	0	26	0
Future Vol, veh/h	1	321	48	0	0	0	0	43	19	0	26	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	92	92	92	90	90	90	90	90	90
Heavy Vehicles, %	10	10	10	2	2	2	55	55	55	40	40	40
Mvmt Flow	1	357	53	0	0	0	0	48	21	0	29	0

Major/Minor	Major1			Minor1			Minor2		
Conflicting Flow All	0	0	0	-	359	179	205	359	-
Stage 1	-	-	-	-	359	-	0	0	-
Stage 2	-	-	-	-	0	-	205	359	-
Critical Hdwy	4.3	-	-	-	7.6	8	8.3	7.3	-
Critical Hdwy Stg 1	-	-	-	-	6.6	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.3	6.3	-
Follow-up Hdwy	2.3	-	-	-	4.55	3.85	3.9	4.4	-
Pot Cap-1 Maneuver	-	-	-	0	461	690	642	488	0
Stage 1	-	-	-	0	510	-	-	-	0
Stage 2	-	-	-	0	-	-	679	539	0
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	-	461	690	573	488	-
Mov Cap-2 Maneuver	-	-	-	-	461	-	573	488	-
Stage 1	-	-	-	-	510	-	-	-	-
Stage 2	-	-	-	-	-	-	597	539	-

Approach	EB	NB	SB
HCM Control Delay, s		13.1	12.8
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	513	-	-	-	488
HCM Lane V/C Ratio	0.134	-	-	-	0.059
HCM Control Delay (s)	13.1	-	-	-	12.8
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.5	-	-	-	0.2

Intersection						
Int Delay, s/veh	0.7					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	3	2	31	43	3
Future Vol, veh/h	2	3	2	31	43	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	25	25	20	20	20	20
Mvmt Flow	2	3	2	32	45	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	83	47	48	0	-	0
Stage 1	47	-	-	-	-	-
Stage 2	36	-	-	-	-	-
Critical Hdwy	6.65	6.45	4.3	-	-	-
Critical Hdwy Stg 1	5.65	-	-	-	-	-
Critical Hdwy Stg 2	5.65	-	-	-	-	-
Follow-up Hdwy	3.725	3.525	2.38	-	-	-
Pot Cap-1 Maneuver	865	961	1451	-	-	-
Stage 1	920	-	-	-	-	-
Stage 2	930	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	864	961	1451	-	-	-
Mov Cap-2 Maneuver	864	-	-	-	-	-
Stage 1	919	-	-	-	-	-
Stage 2	930	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1451	-	920	-	-
HCM Lane V/C Ratio	0.001	-	0.006	-	-
HCM Control Delay (s)	7.5	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	32	0	3	45
Future Vol, veh/h	0	1	32	0	3	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	90	90	20	20	20	20
Mvmt Flow	0	1	38	0	4	54

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	100	38	0	0	38	0
Stage 1	38	-	-	-	-	-
Stage 2	62	-	-	-	-	-
Critical Hdwy	7.3	7.1	-	-	4.3	-
Critical Hdwy Stg 1	6.3	-	-	-	-	-
Critical Hdwy Stg 2	6.3	-	-	-	-	-
Follow-up Hdwy	4.31	4.11	-	-	2.38	-
Pot Cap-1 Maneuver	724	830	-	-	1464	-
Stage 1	799	-	-	-	-	-
Stage 2	778	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	722	830	-	-	1464	-
Mov Cap-2 Maneuver	722	-	-	-	-	-
Stage 1	797	-	-	-	-	-
Stage 2	778	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	830	1464	-
HCM Lane V/C Ratio	-	-	0.001	0.002	-
HCM Control Delay (s)	-	-	9.3	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection						
Int Delay, s/veh	4.5					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	6	33	29	6	33	41
Future Vol, veh/h	6	33	29	6	33	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	92	90	90	92
Heavy Vehicles, %	100	100	20	100	100	20
Mvmt Flow	7	37	32	7	37	45

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	155	36	0	0	39	0
Stage 1	36	-	-	-	-	-
Stage 2	119	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	5.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	3.1	-
Pot Cap-1 Maneuver	653	814	-	-	1117	-
Stage 1	784	-	-	-	-	-
Stage 2	711	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	631	814	-	-	1117	-
Mov Cap-2 Maneuver	631	-	-	-	-	-
Stage 1	757	-	-	-	-	-
Stage 2	711	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.9	0	3.8
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	779	1117	-
HCM Lane V/C Ratio	-	-	0.056	0.033	-
HCM Control Delay (s)	-	-	9.9	8.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	48	650	0	79	9	0	0	5	18
Future Vol, veh/h	0	0	0	48	650	0	79	9	0	0	5	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	69	76	76	69	69	76	76	69	76
Heavy Vehicles, %	2	2	2	10	10	10	30	30	30	30	30	30
Mvmt Flow	0	0	0	70	855	0	114	13	0	0	7	24

Major/Minor	Major2			Minor1				Minor2	
Conflicting Flow All	0	0	0	571	995	-	-	995	428
Stage 1	-	-	-	0	0	-	-	995	-
Stage 2	-	-	-	571	995	-	-	0	-
Critical Hdwy	4.3	-	-	8.1	7.1	-	-	7.1	7.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.1	-
Critical Hdwy Stg 2	-	-	-	7.1	6.1	-	-	-	-
Follow-up Hdwy	2.3	-	-	3.8	4.3	-	-	4.3	3.6
Pot Cap-1 Maneuver	-	-	-	349	201	0	0	201	504
Stage 1	-	-	-	-	-	0	0	265	-
Stage 2	-	-	-	409	265	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	324	201	-	-	201	504
Mov Cap-2 Maneuver	-	-	-	324	201	-	-	201	-
Stage 1	-	-	-	-	-	-	-	265	-
Stage 2	-	-	-	379	265	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		25	15.6
HCM LOS		D	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	305	-	-	-	372
HCM Lane V/C Ratio	0.418	-	-	-	0.083
HCM Control Delay (s)	25	-	-	-	15.6
HCM Lane LOS	D	-	-	-	C
HCM 95th %tile Q(veh)	2	-	-	-	0.3

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	297	60	0	0	0	0	84	49	0	51	0
Future Vol, veh/h	5	297	60	0	0	0	0	84	49	0	51	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	69	92	92	92	94	69	69	94	69	94
Heavy Vehicles, %	20	20	20	2	2	2	30	30	30	30	30	30
Mvmt Flow	5	316	87	0	0	0	0	122	71	0	74	0

Major/Minor	Major1			Minor1			Minor2		
Conflicting Flow All	0	0	0	-	326	158	229	326	-
Stage 1	-	-	-	-	326	-	0	0	-
Stage 2	-	-	-	-	0	-	229	326	-
Critical Hdwy	4.5	-	-	-	7.1	7.5	8.1	7.1	-
Critical Hdwy Stg 1	-	-	-	-	6.1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.1	6.1	-
Follow-up Hdwy	2.4	-	-	-	4.3	3.6	3.8	4.3	-
Pot Cap-1 Maneuver	-	-	-	0	531	778	637	531	0
Stage 1	-	-	-	0	582	-	-	-	0
Stage 2	-	-	-	0	-	-	679	582	0
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	-	531	778	476	531	-
Mov Cap-2 Maneuver	-	-	-	-	531	-	476	531	-
Stage 1	-	-	-	-	582	-	-	-	-
Stage 2	-	-	-	-	-	-	488	582	-

Approach	EB	NB	SB
HCM Control Delay, s		13.8	12.9
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	601	-	-	-	531
HCM Lane V/C Ratio	0.321	-	-	-	0.139
HCM Control Delay (s)	13.8	-	-	-	12.9
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	1.4	-	-	-	0.5

Intersection						
Int Delay, s/veh	1.5					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	2	25	75	46	3
Future Vol, veh/h	3	2	25	75	46	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	33	33	15	15	15	15
Mvmt Flow	4	2	30	91	56	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	209	58	60	0	-	0
Stage 1	58	-	-	-	-	-
Stage 2	151	-	-	-	-	-
Critical Hdwy	6.73	6.53	4.25	-	-	-
Critical Hdwy Stg 1	5.73	-	-	-	-	-
Critical Hdwy Stg 2	5.73	-	-	-	-	-
Follow-up Hdwy	3.797	3.597	2.335	-	-	-
Pot Cap-1 Maneuver	715	927	1464	-	-	-
Stage 1	891	-	-	-	-	-
Stage 2	807	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	699	927	1464	-	-	-
Mov Cap-2 Maneuver	699	-	-	-	-	-
Stage 1	871	-	-	-	-	-
Stage 2	807	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	1.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1464	-	775	-	-
HCM Lane V/C Ratio	0.021	-	0.008	-	-
HCM Control Delay (s)	7.5	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0	-	-

Intersection						
Int Delay, s/veh	0.4					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	1	83	2	3	42
Future Vol, veh/h	2	1	83	2	3	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	50	50	10	10	10	10
Mvmt Flow	3	1	105	3	4	53

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	168	107	0	0	108	0
Stage 1	107	-	-	-	-	-
Stage 2	61	-	-	-	-	-
Critical Hdwy	6.9	6.7	-	-	4.2	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	-	-	2.29	-
Pot Cap-1 Maneuver	723	831	-	-	1434	-
Stage 1	811	-	-	-	-	-
Stage 2	853	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	721	831	-	-	1434	-
Mov Cap-2 Maneuver	721	-	-	-	-	-
Stage 1	809	-	-	-	-	-
Stage 2	853	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.8	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	754	1434	-
HCM Lane V/C Ratio	-	-	0.005	0.003	-
HCM Control Delay (s)	-	-	9.8	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection						
Int Delay, s/veh	3.9					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	6	33	100	8	54	57
Future Vol, veh/h	6	33	100	8	54	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	69	69	92	69	69	92
Heavy Vehicles, %	100	100	100	20	20	100
Mvmt Flow	9	48	109	12	78	62

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	333	115	0	0	121	0
Stage 1	115	-	-	-	-	-
Stage 2	218	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	4.3	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	2.38	-
Pot Cap-1 Maneuver	502	728	-	-	1362	-
Stage 1	715	-	-	-	-	-
Stage 2	633	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	472	728	-	-	1362	-
Mov Cap-2 Maneuver	472	-	-	-	-	-
Stage 1	673	-	-	-	-	-
Stage 2	633	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	4.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	672	1362	-
HCM Lane V/C Ratio	-	-	0.084	0.057	-
HCM Control Delay (s)	-	-	10.8	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.2	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	29	371	0	62	10	0	0	12	0
Future Vol, veh/h	0	0	0	29	371	0	62	10	0	0	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	20	20	20	80	80	80	80	80	80
Mvmt Flow	0	0	0	32	412	0	69	11	0	0	13	0

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	277	476	-	-	476	206
Stage 1	-	-	-	0	0	-	-	476	-
Stage 2	-	-	-	277	476	-	-	0	-
Critical Hdwy	4.5	-	-	9.1	8.1	-	-	8.1	8.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	7.1	-
Critical Hdwy Stg 2	-	-	-	8.1	7.1	-	-	-	-
Follow-up Hdwy	2.4	-	-	4.3	4.8	-	-	4.8	4.1
Pot Cap-1 Maneuver	-	-	-	488	347	0	0	347	606
Stage 1	-	-	-	-	-	0	0	396	-
Stage 2	-	-	-	527	396	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	474	347	-	-	347	606
Mov Cap-2 Maneuver	-	-	-	474	347	-	-	347	-
Stage 1	-	-	-	-	-	-	-	396	-
Stage 2	-	-	-	509	396	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		14.7	15.8
HCM LOS		B	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	451	-	-	-	347
HCM Lane V/C Ratio	0.177	-	-	-	0.038
HCM Control Delay (s)	14.7	-	-	-	15.8
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.6	-	-	-	0.1

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	290	68	0	0	0	0	65	24	2	38	0
Future Vol, veh/h	5	290	68	0	0	0	0	65	24	2	38	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	92	92	92	88	88	88	88	88	88
Heavy Vehicles, %	35	35	35	2	2	2	70	70	70	70	70	70
Mvmt Flow	6	330	77	0	0	0	0	74	27	2	43	0

Major/Minor	Major1			Minor1			Minor2		
Conflicting Flow All	0	0	0	-	342	165	214	342	-
Stage 1	-	-	-	-	342	-	0	0	-
Stage 2	-	-	-	-	0	-	214	342	-
Critical Hdwy	4.8	-	-	-	7.9	8.3	8.9	7.9	-
Critical Hdwy Stg 1	-	-	-	-	6.9	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.9	6.9	-
Follow-up Hdwy	2.55	-	-	-	4.7	4	4.2	4.7	-
Pot Cap-1 Maneuver	-	-	-	0	448	673	571	448	0
Stage 1	-	-	-	0	493	-	-	-	0
Stage 2	-	-	-	0	-	-	606	493	0
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	-	448	673	478	448	-
Mov Cap-2 Maneuver	-	-	-	-	448	-	478	448	-
Stage 1	-	-	-	-	493	-	-	-	-
Stage 2	-	-	-	-	-	-	494	493	-

Approach	EB	NB	SB
HCM Control Delay, s		14.2	13.9
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	492	-	-	-	449
HCM Lane V/C Ratio	0.206	-	-	-	0.101
HCM Control Delay (s)	14.2	-	-	-	13.9
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0.8	-	-	-	0.3

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	0	2	25	36	1
Future Vol, veh/h	6	0	2	25	36	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	79	79	79	79	79
Heavy Vehicles, %	50	50	60	60	60	60
Mvmt Flow	8	0	3	32	46	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	85	47	47	0	-	0
Stage 1	47	-	-	-	-	-
Stage 2	38	-	-	-	-	-
Critical Hdwy	6.9	6.7	4.7	-	-	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	2.74	-	-	-
Pot Cap-1 Maneuver	811	901	1258	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	874	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	809	901	1258	-	-	-
Mov Cap-2 Maneuver	809	-	-	-	-	-
Stage 1	864	-	-	-	-	-
Stage 2	874	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1258	-	809	-	-
HCM Lane V/C Ratio	0.002	-	0.009	-	-
HCM Control Delay (s)	7.9	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	26	0	6	33
Future Vol, veh/h	0	1	26	0	6	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	63	63	63	63
Heavy Vehicles, %	50	50	70	70	70	70
Mvmt Flow	0	2	41	0	10	52

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	113	41	0	0	41	0
Stage 1	41	-	-	-	-	-
Stage 2	72	-	-	-	-	-
Critical Hdwy	6.9	6.7	-	-	4.8	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.95	3.75	-	-	2.83	-
Pot Cap-1 Maneuver	780	909	-	-	1224	-
Stage 1	871	-	-	-	-	-
Stage 2	842	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	774	909	-	-	1224	-
Mov Cap-2 Maneuver	774	-	-	-	-	-
Stage 1	864	-	-	-	-	-
Stage 2	842	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	909	1224	-
HCM Lane V/C Ratio	-	-	0.002	0.008	-
HCM Control Delay (s)	-	-	9	8	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection						
Int Delay, s/veh	7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	66	23	12	86	20
Future Vol, veh/h	10	66	23	12	86	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	92	90	90	92
Heavy Vehicles, %	100	100	50	100	100	50
Mvmt Flow	11	73	25	13	96	22

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	246	32	0	0	38	0
Stage 1	32	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	5.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	3.1	-
Pot Cap-1 Maneuver	571	819	-	-	1119	-
Stage 1	788	-	-	-	-	-
Stage 2	636	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	521	819	-	-	1119	-
Mov Cap-2 Maneuver	521	-	-	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	636	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.3	0	6.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	762	1119	-
HCM Lane V/C Ratio	-	-	0.111	0.085	-
HCM Control Delay (s)	-	-	10.3	8.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.3	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	35	473	0	63	18	0	0	13	7
Future Vol, veh/h	0	0	0	35	473	0	63	18	0	0	13	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	25	25	25	60	60	60	20	20	20
Mvmt Flow	0	0	0	39	526	0	70	20	0	0	14	8

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	348	604	-	-	604	263
Stage 1	-	-	-	0	0	-	-	604	-
Stage 2	-	-	-	348	604	-	-	0	-
Critical Hdwy	4.6	-	-	8.7	7.7	-	-	6.9	7.3
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.9	-
Critical Hdwy Stg 2	-	-	-	7.7	6.7	-	-	-	-
Follow-up Hdwy	2.45	-	-	4.1	4.6	-	-	4.2	3.5
Pot Cap-1 Maneuver	-	-	-	459	309	0	0	375	684
Stage 1	-	-	-	-	-	0	0	444	-
Stage 2	-	-	-	505	365	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	441	309	-	-	375	684
Mov Cap-2 Maneuver	-	-	-	441	309	-	-	375	-
Stage 1	-	-	-	-	-	-	-	444	-
Stage 2	-	-	-	483	365	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		16.5	13.5
HCM LOS		C	B

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	403	-	-	-	445
HCM Lane V/C Ratio	0.223	-	-	-	0.05
HCM Control Delay (s)	16.5	-	-	-	13.5
HCM Lane LOS	C	-	-	-	B
HCM 95th %tile Q(veh)	0.8	-	-	-	0.2

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	639	86	0	0	0	0	76	35	0	48	0
Future Vol, veh/h	2	639	86	0	0	0	0	76	35	0	48	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	625	-	450	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	92	92	92	90	90	90	90	90	90
Heavy Vehicles, %	10	10	10	2	2	2	55	55	55	40	40	40
Mvmt Flow	2	710	96	0	0	0	0	84	39	0	53	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	0	0	0				-	714	355	401	714	-
Stage 1	-	-	-				-	714	-	0	0	-
Stage 2	-	-	-				-	0	-	401	714	-
Critical Hdwy	4.3	-	-				-	7.6	8	8.3	7.3	-
Critical Hdwy Stg 1	-	-	-				-	6.6	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	7.3	6.3	-
Follow-up Hdwy	2.3	-	-				-	4.55	3.85	3.9	4.4	-
Pot Cap-1 Maneuver	-	-	-				0	266	511	451	288	0
Stage 1	-	-	-				0	324	-	-	-	0
Stage 2	-	-	-				0	-	-	505	352	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-				-	266	511	314	288	-
Mov Cap-2 Maneuver	-	-	-				-	266	-	314	288	-
Stage 1	-	-	-				-	324	-	-	-	-
Stage 2	-	-	-				-	-	-	345	352	-

Approach	EB	NB	SB
HCM Control Delay, s		23.8	20.3
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	313	-	-	-	288
HCM Lane V/C Ratio	0.394	-	-	-	0.185
HCM Control Delay (s)	23.8	-	-	-	20.3
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	1.8	-	-	-	0.7

Intersection						
Int Delay, s/veh	0.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	7	5	59	84	6
Future Vol, veh/h	3	7	5	59	84	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	25	25	20	20	20	20
Mvmt Flow	3	7	5	61	88	6

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	162	91	94	0	-	0
Stage 1	91	-	-	-	-	-
Stage 2	71	-	-	-	-	-
Critical Hdwy	6.65	6.45	4.3	-	-	-
Critical Hdwy Stg 1	5.65	-	-	-	-	-
Critical Hdwy Stg 2	5.65	-	-	-	-	-
Follow-up Hdwy	3.725	3.525	2.38	-	-	-
Pot Cap-1 Maneuver	778	907	1394	-	-	-
Stage 1	878	-	-	-	-	-
Stage 2	897	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	775	907	1394	-	-	-
Mov Cap-2 Maneuver	775	-	-	-	-	-
Stage 1	874	-	-	-	-	-
Stage 2	897	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1394	-	863	-	-
HCM Lane V/C Ratio	0.004	-	0.012	-	-
HCM Control Delay (s)	7.6	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	62	0	6	87
Future Vol, veh/h	0	1	62	0	6	87
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	90	90	20	20	20	20
Mvmt Flow	0	1	74	0	7	104

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	192	74	0	0	74	0
Stage 1	74	-	-	-	-	-
Stage 2	118	-	-	-	-	-
Critical Hdwy	7.3	7.1	-	-	4.3	-
Critical Hdwy Stg 1	6.3	-	-	-	-	-
Critical Hdwy Stg 2	6.3	-	-	-	-	-
Follow-up Hdwy	4.31	4.11	-	-	2.38	-
Pot Cap-1 Maneuver	633	789	-	-	1419	-
Stage 1	767	-	-	-	-	-
Stage 2	729	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	630	789	-	-	1419	-
Mov Cap-2 Maneuver	630	-	-	-	-	-
Stage 1	763	-	-	-	-	-
Stage 2	729	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	789	1419	-
HCM Lane V/C Ratio	-	-	0.002	0.005	-
HCM Control Delay (s)	-	-	9.6	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection						
Int Delay, s/veh	4.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	52	59	8	52	82
Future Vol, veh/h	8	52	59	8	52	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	92	90	90	92
Heavy Vehicles, %	100	100	20	100	100	20
Mvmt Flow	9	58	64	9	58	89

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	274	69	0	0	73	0
Stage 1	69	-	-	-	-	-
Stage 2	205	-	-	-	-	-
Critical Hdwy	7.4	7.2	-	-	5.1	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	-	-	3.1	-
Pot Cap-1 Maneuver	548	777	-	-	1080	-
Stage 1	755	-	-	-	-	-
Stage 2	642	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	517	777	-	-	1080	-
Mov Cap-2 Maneuver	517	-	-	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	642	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	3.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	728	1080	-
HCM Lane V/C Ratio	-	-	0.092	0.053	-
HCM Control Delay (s)	-	-	10.4	8.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.2	-

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	56	Opposing Demand Flow Rate, veh/h	30
Peak Hour Factor	0.82	Total Trucks, %	7.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.03

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	62.5
Speed Slope Coefficient	3.60435	Speed Power Coefficient	0.61672
PF Slope Coefficient	-1.13235	PF Power Coefficient	0.83957
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	62.5

Vehicle Results

Average Speed, mi/h	62.5	Percent Followers, %	9.6
Segment Travel Time, minutes	0.96	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 11:54:07
2018AM.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	40	Opposing Demand Flow Rate, veh/h	29
Peak Hour Factor	0.90	Total Trucks, %	6.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.02

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	62.6
Speed Slope Coefficient	3.60464	Speed Power Coefficient	0.61819
PF Slope Coefficient	-1.13105	PF Power Coefficient	0.83992
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.0
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	62.6

Vehicle Results

Average Speed, mi/h	62.6	Percent Followers, %	7.3
Segment Travel Time, minutes	0.96	Followers Density, followers/mi/ln	0.0
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 11:58:18

2018PM.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	13	Opposing Demand Flow Rate, veh/h	11
Peak Hour Factor	0.79	Total Trucks, %	23.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.01

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	62.0
Speed Slope Coefficient	3.55323	Speed Power Coefficient	0.63880
PF Slope Coefficient	-1.11436	PF Power Coefficient	0.84655
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.0
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	62.0

Vehicle Results

Average Speed, mi/h	62.0	Percent Followers, %	2.7
Segment Travel Time, minutes	0.97	Followers Density, followers/mi/ln	0.0
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:00:08

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HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	60	Opposing Demand Flow Rate, veh/h	34
Peak Hour Factor	0.82	Total Trucks, %	7.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.04

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.8
Speed Slope Coefficient	3.78655	Speed Power Coefficient	0.61350
PF Slope Coefficient	-1.11840	PF Power Coefficient	0.84835
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.8

Vehicle Results

Average Speed, mi/h	65.8	Percent Followers, %	9.7
Segment Travel Time, minutes	0.91	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:05:56
2024AM Background.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	46	Opposing Demand Flow Rate, veh/h	32
Peak Hour Factor	0.90	Total Trucks, %	6.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.03

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.9
Speed Slope Coefficient	3.78662	Speed Power Coefficient	0.61517
PF Slope Coefficient	-1.11694	PF Power Coefficient	0.84876
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.9

Vehicle Results

Average Speed, mi/h	65.9	Percent Followers, %	7.8
Segment Travel Time, minutes	0.91	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:07:03
2024PM Background.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	15	Opposing Demand Flow Rate, veh/h	14
Peak Hour Factor	0.79	Total Trucks, %	23.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.01

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.3
Speed Slope Coefficient	3.73578	Speed Power Coefficient	0.63505
PF Slope Coefficient	-1.10166	PF Power Coefficient	0.85539
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.0
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.3

Vehicle Results

Average Speed, mi/h	65.3	Percent Followers, %	3.0
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.0
Vehicle LOS	A		

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2024Facility Background.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	122	Opposing Demand Flow Rate, veh/h	70
Peak Hour Factor	0.82	Total Trucks, %	7.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.07

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.8
Speed Slope Coefficient	3.81240	Speed Power Coefficient	0.58944
PF Slope Coefficient	-1.13830	PF Power Coefficient	0.84157
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.3
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.4

Vehicle Results

Average Speed, mi/h	65.4	Percent Followers, %	17.6
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.3
Vehicle LOS	A		

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2059AM Background.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	91	Opposing Demand Flow Rate, veh/h	66
Peak Hour Factor	0.90	Total Trucks, %	6.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.05

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.9
Speed Slope Coefficient	3.81171	Speed Power Coefficient	0.59170
PF Slope Coefficient	-1.13636	PF Power Coefficient	0.84215
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.2
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.9

Vehicle Results

Average Speed, mi/h	65.9	Percent Followers, %	14.0
Segment Travel Time, minutes	0.91	Followers Density, followers/mi/ln	0.2
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:08:04
2059PM Background.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	29	Opposing Demand Flow Rate, veh/h	25
Peak Hour Factor	0.79	Total Trucks, %	23.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.02

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.3
Speed Slope Coefficient	3.74925	Speed Power Coefficient	0.62166
PF Slope Coefficient	-1.11281	PF Power Coefficient	0.85161
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.0
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.3

Vehicle Results

Average Speed, mi/h	65.3	Percent Followers, %	5.3
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.0
Vehicle LOS	A		

HCS™ Two-Lane Version 7.8
2059Facility Background.xuf
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HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	85	Opposing Demand Flow Rate, veh/h	76
Peak Hour Factor	0.82	Total Trucks, %	30.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.05

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	67.2
Speed Slope Coefficient	3.88842	Speed Power Coefficient	0.58611
PF Slope Coefficient	-1.13101	PF Power Coefficient	0.84802
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.2
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	67.2

Vehicle Results

Average Speed, mi/h	67.2	Percent Followers, %	13.1
Segment Travel Time, minutes	0.89	Followers Density, followers/mi/ln	0.2
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:12:09
2024AM Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	67	Opposing Demand Flow Rate, veh/h	39
Peak Hour Factor	0.82	Total Trucks, %	20.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.04

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.4
Speed Slope Coefficient	3.76727	Speed Power Coefficient	0.60951
PF Slope Coefficient	-1.12271	PF Power Coefficient	0.84801
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.4

Vehicle Results

Average Speed, mi/h	65.4	Percent Followers, %	10.7
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:21:06

2024AM Total 2.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	84	Opposing Demand Flow Rate, veh/h	69
Peak Hour Factor	0.90	Total Trucks, %	55.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.05

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	66.3
Speed Slope Coefficient	3.83920	Speed Power Coefficient	0.58979
PF Slope Coefficient	-1.13023	PF Power Coefficient	0.85061
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.2
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	66.3

Vehicle Results

Average Speed, mi/h	66.3	Percent Followers, %	12.9
Segment Travel Time, minutes	0.90	Followers Density, followers/mi/ln	0.2
Vehicle LOS	A		

 HCS™ Two-Lane Version 7.8 Generated: 03/06/2019 12:18:38

2024PM Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	52	Opposing Demand Flow Rate, veh/h	39
Peak Hour Factor	0.90	Total Trucks, %	20.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.03

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.4
Speed Slope Coefficient	3.76716	Speed Power Coefficient	0.60962
PF Slope Coefficient	-1.12262	PF Power Coefficient	0.84804
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.4

Vehicle Results

Average Speed, mi/h	65.4	Percent Followers, %	8.8
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

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2024PM Total 2.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	87	Opposing Demand Flow Rate, veh/h	68
Peak Hour Factor	0.79	Total Trucks, %	70.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.05

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.8
Speed Slope Coefficient	3.81179	Speed Power Coefficient	0.59009
PF Slope Coefficient	-1.13124	PF Power Coefficient	0.85161
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.2
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.8

Vehicle Results

Average Speed, mi/h	65.8	Percent Followers, %	13.2
Segment Travel Time, minutes	0.91	Followers Density, followers/mi/ln	0.2
Vehicle LOS	A		

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2024Facility Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	24	Opposing Demand Flow Rate, veh/h	23
Peak Hour Factor	0.79	Total Trucks, %	50.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.01

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	64.4
Speed Slope Coefficient	3.69785	Speed Power Coefficient	0.62429
PF Slope Coefficient	-1.11248	PF Power Coefficient	0.85395
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.0
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	64.4

Vehicle Results

Average Speed, mi/h	64.4	Percent Followers, %	4.5
Segment Travel Time, minutes	0.93	Followers Density, followers/mi/ln	0.0
Vehicle LOS	A		

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2024Facility Total 2.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	162	Opposing Demand Flow Rate, veh/h	135
Peak Hour Factor	0.82	Total Trucks, %	30.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.10

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	67.2
Speed Slope Coefficient	3.91889	Speed Power Coefficient	0.55993
PF Slope Coefficient	-1.15200	PF Power Coefficient	0.84047
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.5
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	66.3

Vehicle Results

Average Speed, mi/h	66.3	Percent Followers, %	22.1
Segment Travel Time, minutes	0.90	Followers Density, followers/mi/ln	0.5
Vehicle LOS	A		

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2059AM Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	132	Opposing Demand Flow Rate, veh/h	77
Peak Hour Factor	0.82	Total Trucks, %	20.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.08

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.4
Speed Slope Coefficient	3.79337	Speed Power Coefficient	0.58546
PF Slope Coefficient	-1.14263	PF Power Coefficient	0.84124
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.4
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	64.9

Vehicle Results

Average Speed, mi/h	64.9	Percent Followers, %	18.7
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.4
Vehicle LOS	A		

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2059AM Total 2.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	149	Opposing Demand Flow Rate, veh/h	123
Peak Hour Factor	0.90	Total Trucks, %	55.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.09

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	66.3
Speed Slope Coefficient	3.86828	Speed Power Coefficient	0.56449
PF Slope Coefficient	-1.15074	PF Power Coefficient	0.84335
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.5
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.6

Vehicle Results

Average Speed, mi/h	65.6	Percent Followers, %	20.6
Segment Travel Time, minutes	0.91	Followers Density, followers/mi/ln	0.5
Vehicle LOS	A		

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2059PM Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	100	Opposing Demand Flow Rate, veh/h	74
Peak Hour Factor	0.90	Total Trucks, %	20.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.06

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.4
Speed Slope Coefficient	3.79195	Speed Power Coefficient	0.58673
PF Slope Coefficient	-1.14158	PF Power Coefficient	0.84160
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.2
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.4

Vehicle Results

Average Speed, mi/h	65.4	Percent Followers, %	15.2
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.2
Vehicle LOS	A		

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2059PM Total 2.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between SH 31 and Site Driveway	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	6
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	134	Opposing Demand Flow Rate, veh/h	113
Peak Hour Factor	0.79	Total Trucks, %	70.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.08

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	65.8
Speed Slope Coefficient	3.83611	Speed Power Coefficient	0.56879
PF Slope Coefficient	-1.14861	PF Power Coefficient	0.84551
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.4
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	65.3

Vehicle Results

Average Speed, mi/h	65.3	Percent Followers, %	19.0
Segment Travel Time, minutes	0.92	Followers Density, followers/mi/ln	0.4
Vehicle LOS	A		

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2059Facility Total 1.xuf

HCS7 Two-Lane Highway Report

Project Information

Analyst	KWN	Date	3/4/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Traffic Study - FM 939 between Site Driveway and Happy Swaner Ln	Unit	United States Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	12	Shoulder Width, ft	3
Speed Limit, mi/h	60	Access Point Density, pts/mi	1.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	44	Opposing Demand Flow Rate, veh/h	38
Peak Hour Factor	0.79	Total Trucks, %	50.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.03

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	64.4
Speed Slope Coefficient	3.71225	Speed Power Coefficient	0.61034
PF Slope Coefficient	-1.12415	PF Power Coefficient	0.85003
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	0.1
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	64.4

Vehicle Results

Average Speed, mi/h	64.4	Percent Followers, %	7.6
Segment Travel Time, minutes	0.93	Followers Density, followers/mi/ln	0.1
Vehicle LOS	A		

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2059Facility Total 2.xuf

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	144	Heavy Vehicle Adjustment Factor (f_{HV})	0.758
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	101
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.05

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	1.5
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	77	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	22	Bicyle LOS Score (BLOS)	7.10
Average Effective Width (W_e), ft	27	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	322	Heavy Vehicle Adjustment Factor (f_{HV})	0.833
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	254
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.12

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	3.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	212	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	5.35
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	E

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	307	Heavy Vehicle Adjustment Factor (f_{HV})	0.893
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	191
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.09

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	2.9
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	171	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	4.12
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	D

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	225	Heavy Vehicle Adjustment Factor (f_{HV})	0.704
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	178
Total Trucks, %	21.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.08

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	2.7
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	125	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	11.26
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	135	Heavy Vehicle Adjustment Factor (f_{HV})	0.746
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	103
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.05

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	1.6
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	77	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	23	Bicyle LOS Score (BLOS)	7.41
Average Effective Width (W_e), ft	28	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2018 Existing
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	172	Heavy Vehicle Adjustment Factor (f_{HV})	0.806
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	118
Total Trucks, %	12.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.05

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	1.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	96	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	5.87
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	162	Heavy Vehicle Adjustment Factor (f_{HV})	0.758
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	114
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.05

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	1.7
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	86	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	8.39
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	364	Heavy Vehicle Adjustment Factor (f_{HV})	0.833
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	288
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.13

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	4.4
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	239	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	5.41
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	E

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	347	Heavy Vehicle Adjustment Factor (f_{HV})	0.893
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	216
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.10

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	3.3
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	193	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	4.18
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	D

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	254	Heavy Vehicle Adjustment Factor (f_{HV})	0.704
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	200
Total Trucks, %	21.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.09

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	3.0
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	141	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	11.32
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	153	Heavy Vehicle Adjustment Factor (f_{HV})	0.746
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	116
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.05

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	1.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	87	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	21	Bicyle LOS Score (BLOS)	8.02
Average Effective Width (W_e), ft	26	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	194	Heavy Vehicle Adjustment Factor (f_{HV})	0.806
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	134
Total Trucks, %	12.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.06

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	2.0
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	108	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	5.93
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	325	Heavy Vehicle Adjustment Factor (f_{HV})	0.758
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	228
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	3.5
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	173	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	8.74
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	724	Heavy Vehicle Adjustment Factor (f_{HV})	0.833
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	572
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.26

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	8.7
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	476	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	5.76
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information			
Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data			
Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors			
Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity			
Volume(V) veh/h	691	Heavy Vehicle Adjustment Factor (f_{HV})	0.893
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	430
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.20

Direction 1 Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	6.6
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS			
Flow Rate in Outside Lane (v_{OL}),veh/h	384	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	4.53
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	E

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	507	Heavy Vehicle Adjustment Factor (f_{HV})	0.704
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	400
Total Trucks, %	21.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.19

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	6.1
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	282	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	11.67
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	304	Heavy Vehicle Adjustment Factor (f_{HV})	0.746
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	232
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	3.5
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	173	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	9.32
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Background
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	387	Heavy Vehicle Adjustment Factor (f_{HV})	0.806
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	266
Total Trucks, %	12.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.12

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	4.0
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	215	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	6.28
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	186	Heavy Vehicle Adjustment Factor (f_{HV})	0.714
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	138
Total Trucks, %	20.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.06

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	2.1
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	99	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	10.93
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

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Project Information

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Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	380	Heavy Vehicle Adjustment Factor (f_{HV})	0.769
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	325
Total Trucks, %	15.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.15

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	4.9
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	250	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	7.90
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	PM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	370	Heavy Vehicle Adjustment Factor (f_{HV})	0.833
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	247
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	3.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	206	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	5.79
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

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Project Information

Analyst	KWN	Date	3/6/2019
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Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	277	Heavy Vehicle Adjustment Factor (f_{HV})	0.667
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	230
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	3.5
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	154	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	14.28
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
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Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	192	Heavy Vehicle Adjustment Factor (f_{HV})	0.588
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	186
Total Trucks, %	35.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.09

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	2.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	109	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	23.43
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2024 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	223	Heavy Vehicle Adjustment Factor (f_{HV})	0.714
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	174
Total Trucks, %	20.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.08

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	2.6
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	124	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	10.58
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

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Jurisdiction		Time Period Analyzed	AM Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	362	Heavy Vehicle Adjustment Factor (f_{HV})	0.714
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	270
Total Trucks, %	20.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.12

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	4.1
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	193	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	11.27
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
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Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	747	Heavy Vehicle Adjustment Factor (f_{HV})	0.769
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	639
Total Trucks, %	15.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.30

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	9.7
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	491	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	8.25
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
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Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data

Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity

Volume(V) veh/h	727	Heavy Vehicle Adjustment Factor (f_{HV})	0.833
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	485
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.22

Direction 1 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	7.4
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	404	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	6.13
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Total
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Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	543	Heavy Vehicle Adjustment Factor (f_{HV})	0.667
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	452
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.21

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	6.8
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	302	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	14.63
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information			
Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 1 Geometric Data			
Direction 1	EB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	5
Median Type	Divided	Total Lateral Clearance (TLC), ft	10
Free-Flow Speed (FFS), mi/h	69.1		

Direction 1 Adjustment Factors			
Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 1 Demand and Capacity			
Volume(V) veh/h	363	Heavy Vehicle Adjustment Factor (f_{HV})	0.588
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	351
Total Trucks, %	35.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.16

Direction 1 Speed and Density			
Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.6
Total Lateral Clearance Adj. (f_{LLC})	0.4	Density (D), pc/mi/ln	5.4
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 1 Bicycle LOS			
Flow Rate in Outside Lane (v_{OL}),veh/h	206	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	17	Bicyle LOS Score (BLOS)	23.75
Average Effective Width (W_e), ft	22	Bicycle Level of Service (LOS)	F

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HCS7 Multilane Highway Report

Project Information

Analyst	KWN	Date	3/6/2019
Agency		Analysis Year	2059 Total
Jurisdiction		Time Period Analyzed	Facility Peak
Project Description	Waco Landfill Study - SH 31 West of FM 939	Unit	United States Customary

Direction 2 Geometric Data

Direction 2	WB		
Number of Lanes (N), ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Access Point Density, pts/mi	2.0
Lane Width, ft	12	Left-Side Lateral Clearance (LC_R), ft	6
Median Type	Divided	Total Lateral Clearance (TLC), ft	12
Free-Flow Speed (FFS), mi/h	69.5		

Direction 2 Adjustment Factors

Driver Population	Balanced Mix	Final Speed Adjustment Factor (SAF)	0.950
Driver Population SAF	0.950	Final Capacity Adjustment Factor (CAF)	0.939
Driver Population CAF	0.939		

Direction 2 Demand and Capacity

Volume(V) veh/h	433	Heavy Vehicle Adjustment Factor (f_{HV})	0.714
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	337
Total Trucks, %	20.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2160
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.16

Direction 2 Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.0
Total Lateral Clearance Adj. (f_{LLC})	0.0	Density (D), pc/mi/ln	5.1
Median Type Adjustment (f_M)	0.0	Level of Service (LOS)	A
Access Point Density Adjustment (f_A)	0.5		

Direction 2 Bicycle LOS

Flow Rate in Outside Lane (v_{OL}),veh/h	241	Effective Speed Factor (S_t)	5.19
Effective Width of Volume (W_v), ft	18	Bicyle LOS Score (BLOS)	10.92
Average Effective Width (W_e), ft	24	Bicycle Level of Service (LOS)	F

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APPENDIX I/IIE

SECTION 404 JURISDICTIONAL DETERMINATION

October 2020

Horizon™
Environmental Services, Inc.

SECTION 404 JURISDICTIONAL DETERMINATION
NEW CITY OF WACO LANDFILL
MCLENNAN AND LIMESTONE COUNTIES, TEXAS

PREPARED FOR:

CITY OF WACO

PREPARED BY:

HORIZON ENVIRONMENTAL SERVICES, INC.

OCTOBER 2020

Waco 50 JD.doc

CORPORATE HEADQUARTERS
1507 South IH 35 ★ Austin, Texas 78741 ★ 512.328.2430 ★ Fax 512.328.1804 ★ www.horizon-esi.com
An LJA Company

Introduction

Horizon Environmental Services, Inc.'s (Horizon) has evaluated the site for potential water features that may be subject to jurisdiction under Section 404 of the Clean Water Act and regulated by the US Army Corps of Engineers (USACE) (wetlands and other "waters of the U.S."). This letter provides the results of that jurisdictional determination.

Project Location

The proposed New Waco Landfill will be a Type I municipal solid waste landfill operated by the City of Waco. The New Landfill is located approximately 16 miles northeast of Waco south of State Highway 31 and east of FM 939 (TK Parkway) in McLennan and Limestone counties (Figure 1). The new landfill will be located on a 502.5 acre property in two separate landfill development units comprising a total of 173.8 acres (Figure 2). The two development units are separated by a tributary referred to as Horse Creek that is a tributary to Williams Creek, a tributary to Tehuacana Creek and the Brazos River (Figure 3).

Jurisdictional Determination

The jurisdictional determination consisted of a pre-field literature review and a site assessment conducted according to the general methodologies prescribed by the 1987 USACE *Wetlands Delineation Manual*, *the* Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0), and USACE Regulatory Guidance Letter No. 05-05 (7 December 2005). Jurisdiction has been determined in accordance with 2008 Clean Water Act Jurisdictional Determination Guidance (Rapanos Guidance) despite the recent implementation of the 2020 Navigable Waters Protection Rule as the longevity of that new rule is uncertain.

Under the 2008 Rapanos guidance, areas subject to jurisdiction under Section 404 of the Clean Water Act are referred to as "waters of the U.S." including wetlands. Federal regulations (33 CFR 328.3) define waters of the US as the following features:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters including interstate wetlands;
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
    i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
    ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

   iii. Which are used or could be used for industrial purpose by industries in interstate commerce;
4. All impoundments of waters otherwise defined as waters of the United States under the definition;
5. Tributaries of waters identified in paragraphs (a)(1)-(4) of this section;
6. The territorial seas;
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.
8. Waters of the United States do not include prior converted cropland.

The term **"wetlands"** means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (EPA, 40 CFR §230.3). Wetlands are technically identified by the presence of hydrophytic vegetation, hydric soils, and evidence of frequent or prolonged hydrology.

Pre-field Evaluation

The literature evaluation included a review of the US Geological Survey (USGS) topographic map, Federal Emergency Management Agency (FEMA) flood hazard map, US Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) map, color aerial photography, and US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey information to evaluate the subject site for potential wetlands or other water features that would require further assessment during the field investigation. The literature evaluation determined that there were potential water features, primarily streams and impoundments, within the project boundaries. Specifically, the USGS map revealed the presence of Horse Creek and a number of unnamed tributaries, as well as several impoundments. SCS Conservation Reservoir #19 is present just south of the site and backs water up Horse Creek on the southern portion of the site. Historic aerial photographs indicate that the Property remained generally unchanged since prior to 1995.

Field Reconnaissance

During a field reconnaissance in December of 2017 Horizon personnel field verified those areas identified as potential water features during the pre-field evaluation to determine which features, if any, met the USACE criteria to be classified as jurisdictional under the 2008 Rapanos Guidance and subject to regulation under Section 404 of the Clean Water Act.

Vegetation species observed on the majority of the site were all classified as upland species. The site is generally characterized as undeveloped woodland and grazing pasture. The site has previously been used for cattle grazing and as an ATV park. Common species of the woodlands include post oak (*Quercus stellata*), blackjack oak (*Quercus* marilandica), cedar elm (*Ulmus* crassifolia), yaupon (*Ilex vomitoria*), greenbriar (*Smilax bona-nox*), and grape (*Vitis* *mustangensis*). Riparian and bottomland areas along Horse Creek contain cedar elm, hackberry (*Celtis* laevigata), and pecan (*Carya illinoiensis*). The backwater area of the SCS conservation reservoir exhibits wetland characteristics dominated by green ash (*Fraxinus pensylvanica*), smartweed (*Polygonum sp*), and cocklebur (*Xanthium* sp.). Grazing pastures include various bluestems, forbs, and mesquite (*Prosopis* glandulosa). On-site photographs are provided in Attachment 2.

Horse Creek is determined to be intermittent waters of the US (Figure 3). Several tributaries to Horse Creek are determined to be ephemeral and exhibited an ordinary high water mark. All on-channel stock ponds are on ephemeral tributaries. Wetlands and open water are present in the area of the SCS reservoir backwater on the southern portion of the property and are determined to be adjacent to or an impoundment of Horse Creek (Figure 4 and 5).

The two proposed disposal areas were designed to avoid Horse Creek and the wetlands on the southern portion of the property. The western disposal area avoids all water features. The boundary of the eastern disposal area was reduced as much as possible to minimize the extent of water features affected but could not completely avoid two ephemeral tributaries and a small on-channel stock pond without significantly reducing capacity below acceptable levels.

Based on our on-site jurisdictional review and the current landfill development plan, it is our opinion that portions of three ephemeral tributaries to Horse Creek, a small portion of Horse Creek, and an on-channel stock pond (open water) occur within the landfill development footprint (Figure 6). Due to engineering design refinements, impacts to water features have been reduced as much as reasonably practicable. Temporary impacts will constitute grading or disturbance for construction of facilities, but no permanent loss of waters. The table below indicates the impacts of the current landfill design.

TABLE 1: LANDFILL IMPACTS TO WATER FEATURES

Feature Number	Temporary Impacts (LF)	Permanent Impacts (LF)	Permanent Impacts (sqft)
19	129.84	98.0	--
20	65.15	0	--
21	95.90	52.68	--
23	0	1031.29	--
24	0	325.3	--
Pond	--	--	3609.8
TOTAL	**290.89**	**1507.27**	**3609.8**

Section 404 Clean Water Act Summary

Based on the pre-field literature review, field investigation, and the current engineering design of the landfill, Horizon determined that the western disposal area will avoid all water features and the eastern disposal area contains portions of two ephemeral tributaries and a small stock pond. Road crossings will result in both permanent and temporary impacts to a small portion of Horse Creek (intermittent) and portions of another ephemeral tributary. All water features are being considered jurisdictional despite ramifications of the 2020 Navigable Waters Protection Rule. A permit from the USACE is being sought for development of the landfill project.

TCEQ Wetland Restriction Summary (30 TAC § 330.553)

Based on the pre-field literature review, field investigation, and the current engineering design of the landfill, Horizon determined that the western disposal area will avoid all water features and the eastern disposal area contains portions of two ephemeral tributaries and a small stock pond. Road crossings will result in both permanent and temporary impacts to a small portion of Horse Creek (intermittent) and portions of another ephemeral tributary. These features are considered non-wetland waters of the US. No portion of the landfill footprint is located within or affecting wetlands. No wetlands will be impacted by the landfill construction or operation.

Please call with any questions.

For Horizon Environmental Services Inc.

C. Lee Sherrod

C. Lee Sherrod
Senior Project Manager
Certified Professional Wetland Scientist

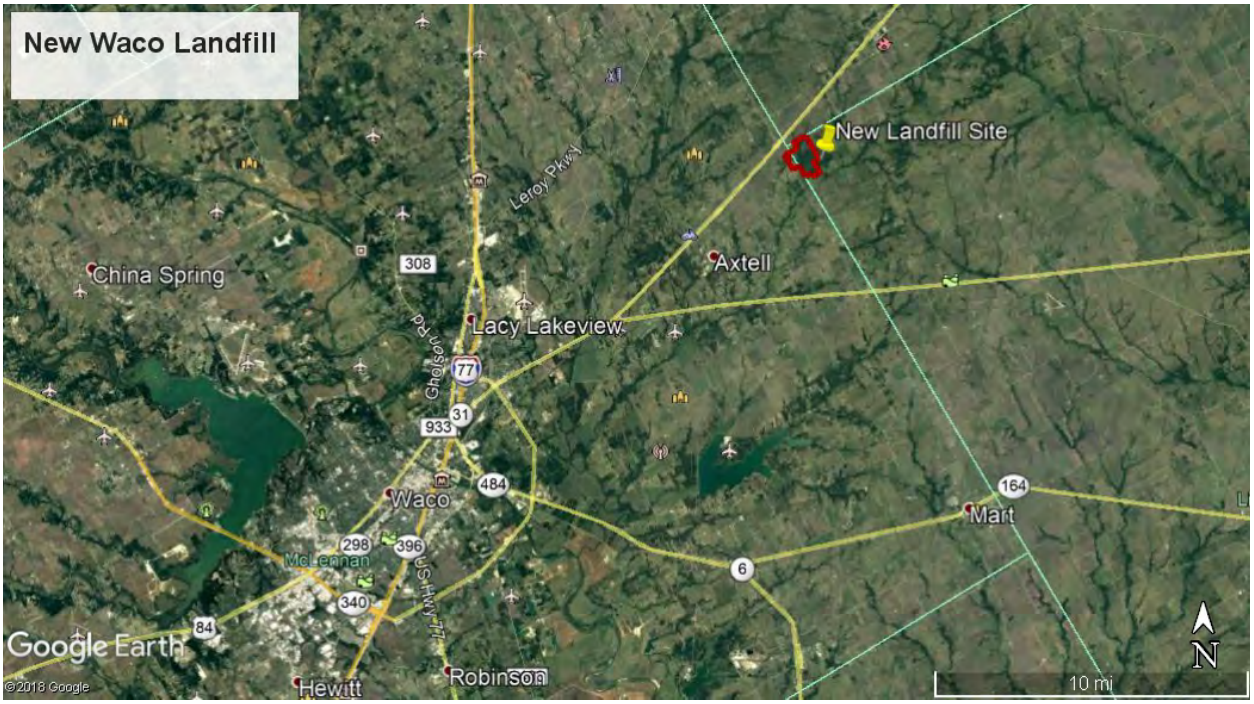


FIGURE 1: LOCATION

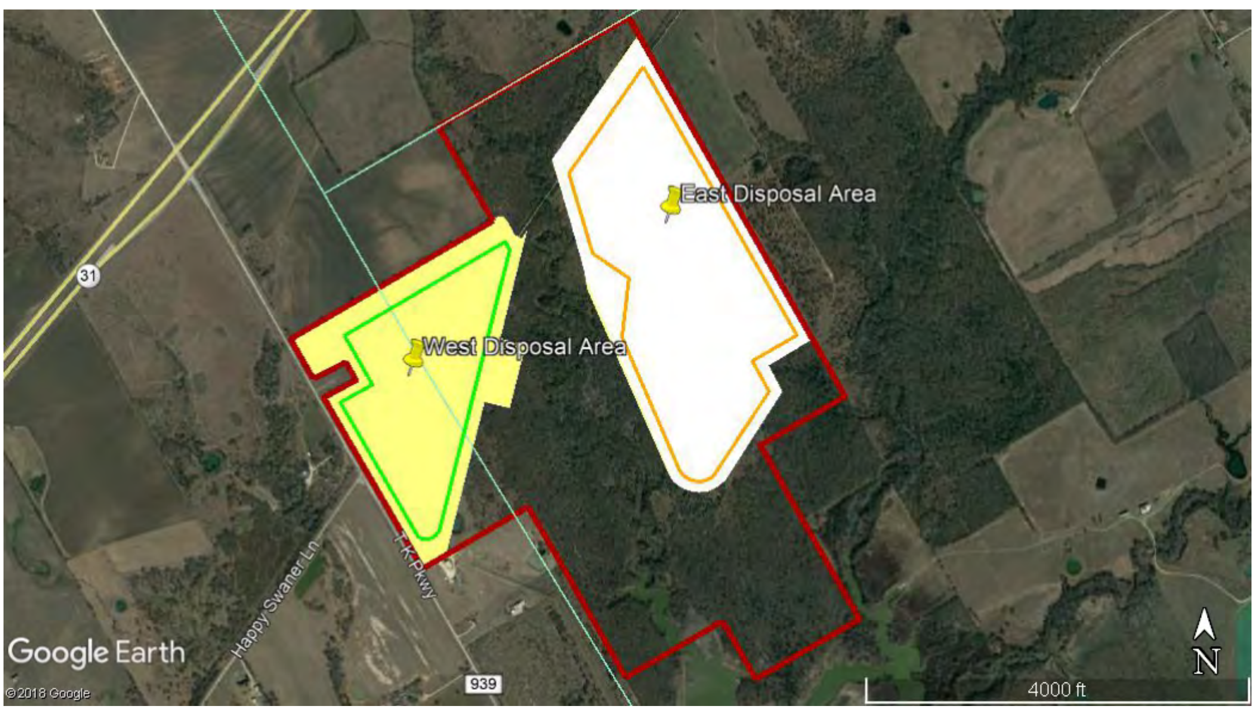


FIGURE 2: PROPERTY BOUNDARY AND DISPOSAL UNITS

Waco 50 Landfill JD.doc

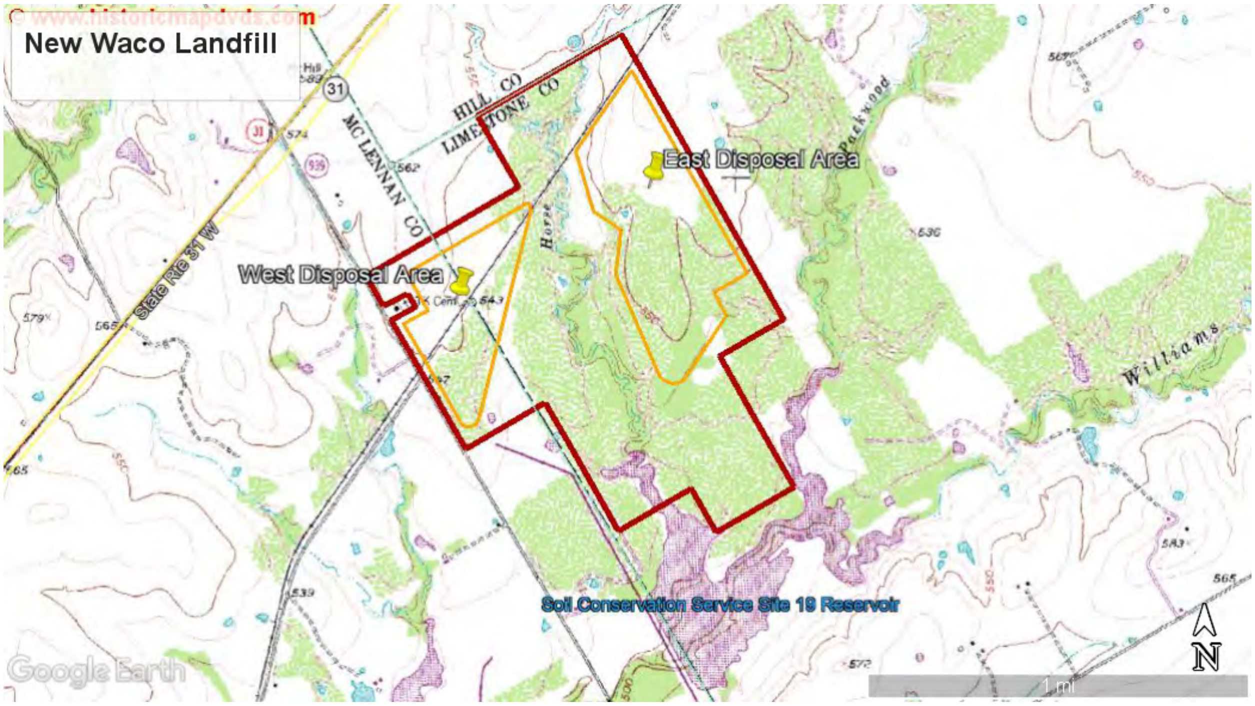


FIGURE 3: TOPO MAP

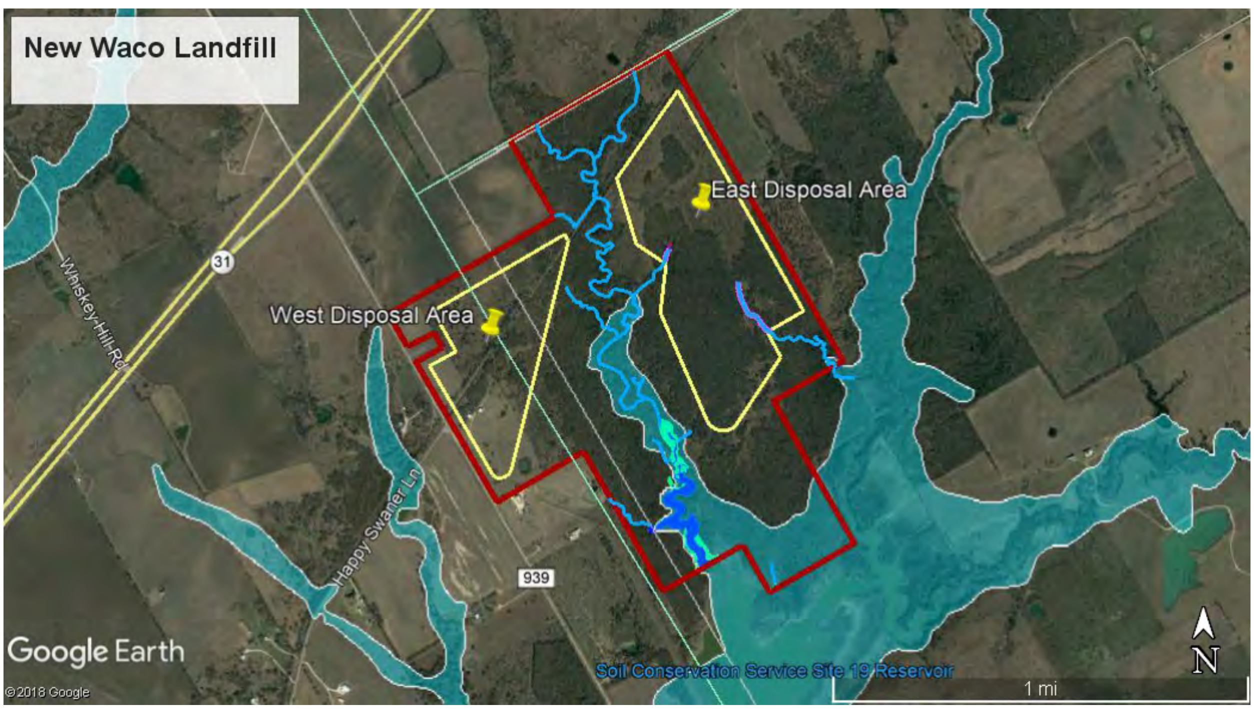


FIGURE 4: SITE CONFIGURATION, JURISDICTIONAL DETERMINATION, FLOODPLAIN

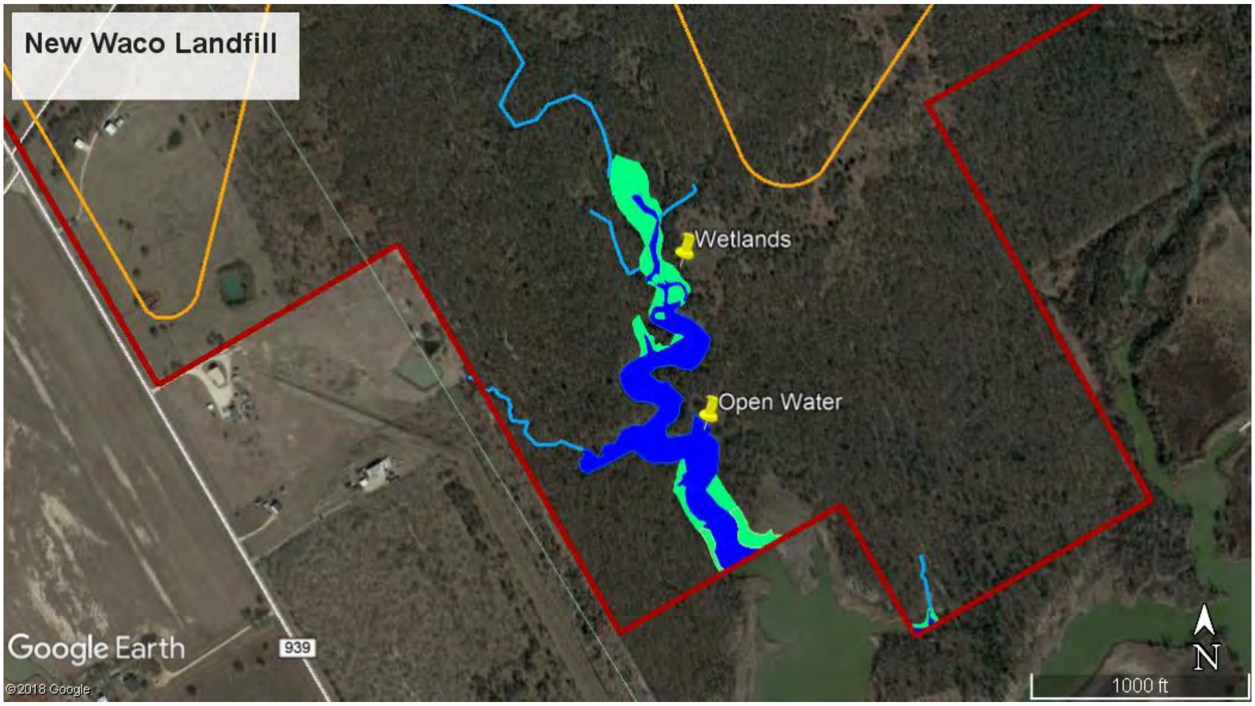
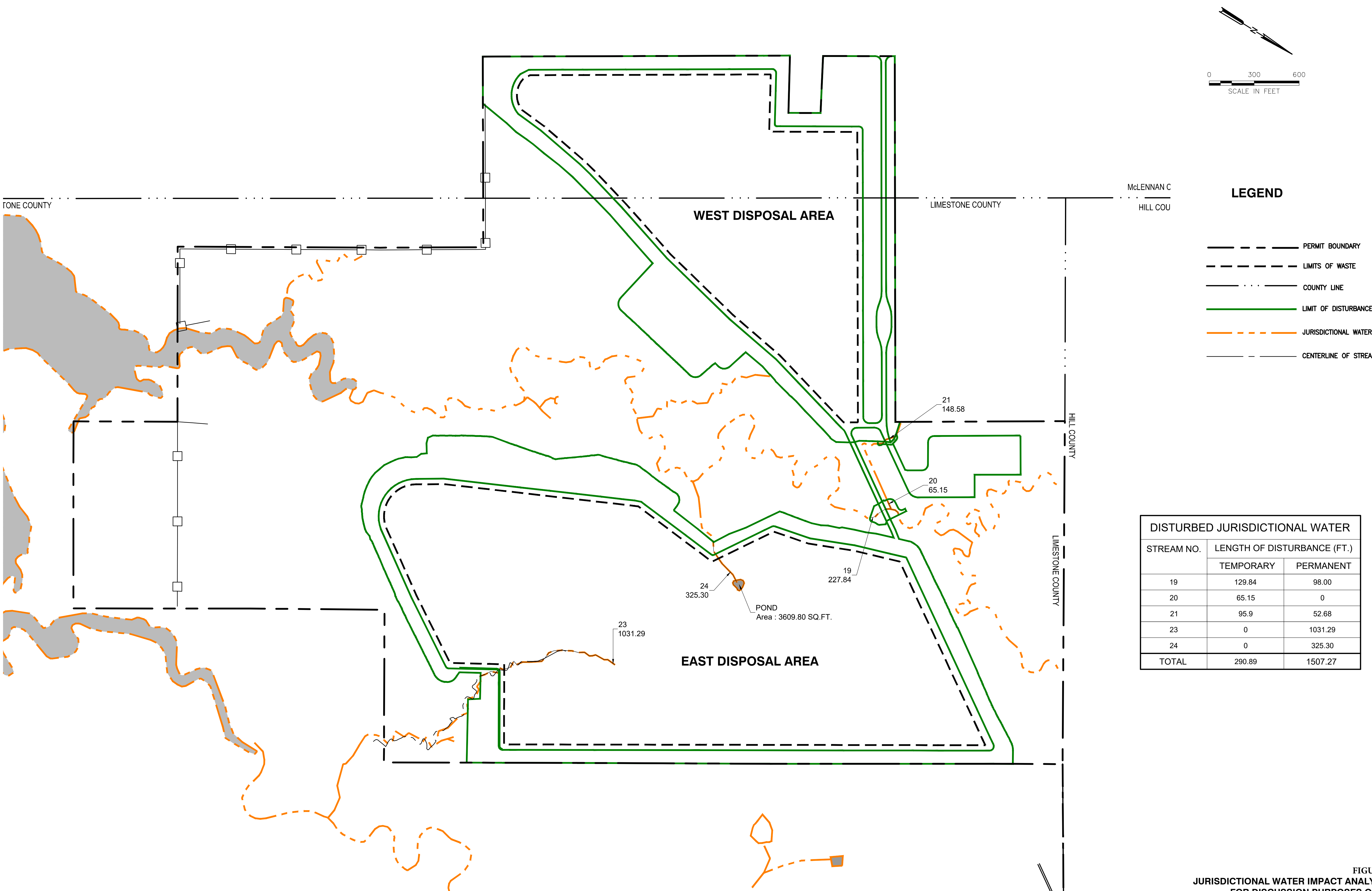


FIGURE 5: WETLANDS AND OPEN WATER ON SOUTHERN PORTION OF SITE NOT AFFECTED BY THE LANDFILL



DISTURBED JURISDICTIONAL WATER

STREAM NO.	LENGTH OF DISTURBANCE (FT.)	
	TEMPORARY	PERMANENT
19	129.84	98.00
20	65.15	0
21	95.9	52.68
23	0	1031.29
24	0	325.30
TOTAL	290.89	1507.27

FIGURE 6
JURISDICTIONAL WATER IMPACT ANALYSIS
FOR DISCUSSION PURPOSES ONLY
October 2020
SCS ENGINEERS

ATTACHMENT 1

ON-SITE PHOTOS

PHOTO 1
Horse Creek (No Impact)

PHOTO 2
Horse Creek (No Impact)

PHOTO 3
SCS Reservoir Backwater Area and Wetlands

PHOTO 4
SCS Reservoir Backwater Area and Wetlands

PHOTO 5
Tributary of Horse Creek to be Impacted

PHOTO 6
Tributary of Horse Creek to be Impacted

APPENDIX I/IIG

BIOLOGICAL ASSESSMENT

Horizon™
Environmental Services, Inc.

BIOLOGICAL ASSESSMENT
NEW CITY OF WACO LANDFILL
MCLENNAN AND LIMESTONE COUNTIES, TEXAS

PREPARED FOR:

CITY OF WACO

PREPARED BY:

HORIZON ENVIRONMENTAL SERVICES, INC.

FEBRUARY 2020

CORPORATE OFFICE
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An LJA Company

INTRODUCTION

Horizon Environmental Services, Inc. has conducted a biological assessment of the proposed new City of Waco Landfill to determine the effect of the proposed landfill on any state or federally listed threatened or endangered species and the existence of any potentially suitable habitat for any such species. The assessment included a literature and agency records search and a number of site reconnaissance efforts between December, 2017 and May, 2019 by several qualified Horizon biologists. The dates of field observations were appropriate for the studied species based on each species' migration periods, nesting or blooming periods, and the type of habitat involved. Prior to the site investigations, records and files maintained by the Texas Parks and Wildlife Department, Natural Diversity Data Base (TPWD-NDD) and the U.S. Fish and Wildlife Service, Information for Planning and Consultation (USFWS-IPAC) web sites were inspected to determine if any listed species or habitat were previously recorded. A list of state and federal species of potential occurrence in McLennan and Limestone Counties was also obtained from each agency. Color aerial photography and USGS topographic maps were acquired to aid the field reconnaissance efforts.

This Biological Assessment also includes a management plan for migratory birds protected under the Migratory Bird Treaty Act.

BACKGROUND

The proposed New Waco Landfill will be a Type I municipal solid waste landfill operated by the City of Waco. The New Landfill is located approximately 16 miles northeast of Waco south of State Highway 31 and east of FM 939 (TK Parkway) in McLennan and Limestone counties (Figure 1, Appendix A). The new landfill will be located on a 502.5 acre property in two separate landfill development units comprising a total of 176 acres (Figure 2, Appendix A). The two development units are separated by a tributary referred to as Horse Creek that is a tributary to Williams Creek, a tributary to Tehuacana Creek and the Brazos River (Figure 3, Appendix A). The proposed landfill footprint has been designed to avoid Horse Creek and its associated floodplain (Figure 2, Appendix A). Site configuration is also constrained by the 100-year floodplain along Horse Creek. Site photographs are included in Appendix B.

LISTED THREATENED AND ENDANGERED SPECIES

Table 1 provides a list of the State and Federally protected species whose distribution includes McLennan and Limestone counties. The table was compiled as a result of the above mentioned agency information review. USFWS-IPAC lists and TPWD-NDD lists for McLennan and Limestone counties are included in Appendix C.

TABLE 1: STATE- AND FEDERALLY-LISTED THREATENED OR ENDANGERED SPECIES OF POTENTIAL OCCURRENCE IN MCLENNAN AND LIMESTONE COUNTIES

Taxon	Common Name	Scientific Name	Federal Status	State Status
Birds	Peregrine Falcon	*Falco peregrinus*	DL	T
	American Peregrine Falcon	*Falco peregrinus anatum*	DL	T
	Whooping Crane	*Grus americana*	E	E
	Bald Eagle	*Haliaeetus leucocephalus*	DL	T

Taxon	Common Name	Scientific Name	Federal Status	State Status
	Interior Least Tern	*Sterna antillarum* athalassos	E	E
	Golden-cheeked Warbler	*Setophaga chrysoparia*	E	E
	White-faced Ibis	*Plegadis chihi*	--	T
	Wood Stork	*Mycteria americana*	--	T
	Piping Plover	*Charadrius melodus*	T	T
	Red Knot	*Calidris canutus rufa*	T	--
Fishes	Sharpnose shiner	*Micropterus treculii*	E	--
	Smalleye shiner	*Notropis oxyrhynchus*	E	--
Mammals	Gray Wolf	*Canis lupus*	E	E
Mollusks	Smooth pimpleback	*Quadrula houstonensis*	C	T
	Texas fawnsfoot	*Truncilla macrodon*	C	T
Reptiles	Timber rattlesnake	*Crotalus horridus*	--	T
	Texas garter snake	*Thamnophis sirtalis annectens*	--	SGCN
	Texas Horned Lizard	*Phrynosoma cornutum*	--	T
	Alligator snapping turtle	*Macrochelys temminckii*	--	T
Plants	Navasota ladies-tresses	*Spiranthes parksii*	E	E

1 E = Endangered: Species in danger of extinction throughout all or a significant portion of its range.
T = Threatened: Species is likely to become listed as an endangered species.
T/SA: NL – Threatened due to similar appearance: not listed.
DL = Delisted: Species is no longer listed as threatened or endangered.
C = Candidate for Federal Listing
SGCN = Species of Greatest Conservation Need (State designation)

2 Source: USFWS IPAC Threatened and Endangered Species List for Waco Landfill, McLennan and Limestone Counties (https://ecos.fws.gov/ipac/) 2018 and Texas Parks and Wildlife Department, Natural Diversity Data Base (http://tpwd.texas.gov/gis/rtest/) 2018 (Appendix C).

The TPWD-NDD list (Appendix C) also includes several rare species, including the western burrowing owl, Arctic peregrine falcon, Sprague's pipit, Henslow's sparrow, cave myotis bat, plains spotted skunk, Texas garter snake, Guadalupe bass, plateau milkvine, Texas milk vetch, tree dodder, goldenwave tick seed, small headed pipewort, and Texas sandmint as possibly occurring in McLennan and Limestone counties. However, none of these species are listed by the State or Federal government as threatened or endangered; therefore, none of these species are addressed further in this report with the exception of the Texas garter snake. The Texas garter snake was identified as potentially occurring on or near the landfill site by Texas Parks and Wildlife Department, Natural Diversity Data Base.

Birds

Peregrine Falcons (state list)

The two peregrine falcons were federally delisted in 1999, but TPWD has not as yet followed suit at the state level. Suitable nesting habitat for the two peregrines includes large rocky bluffs and canyons. However, no bluffs or canyons occur on the subject site. Both birds are migratory across Texas and could temporarily occur in the area as transients who are opportunistic feeders. Any such temporary occurrence during migrations would not be precluded by the landfill; however, no adverse effects to peregrines would be expected because they are quite tolerant of human activity and are known to winter in urban areas and very active ports along the Gulf Coast.

Whooping Crane (state and federal lists)

The whooping crane is migratory and passes over much of Texas on its migration route between the Texas coast and southern Canada. It may occasionally stop over at points along the way that provide temporary feeding or resting habitat such as large wetlands, playa lakes, or agricultural fields. The site does not provide any usable habitat for the whooping crane. The whooping crane would not be expected on the site.

Bald Eagle (state list)

The bald eagle is represented in Texas by both migratory and non-migratory individuals. Nesting or wintering eagles are increasing in Texas and are found around large bodies of water such as rivers and reservoirs. SCS Reservoir #19 is adjacent to the landfill site to the south. SCS Reservoir #20 is located approximately 1 mile to the southwest of the proposed landfill. Eagles can range a considerable distance in daily flights or migrations, and it is not uncommon to see them flying over any area within 20 or 30 miles of suitable habitat areas. They rarely land in or utilize any other habitats other than near large water bodies. Large water bodies are an essential component of suitable habitat because fish and waterfowl make up the majority of the eagle's diets.

Due to the proximity of the two SCS reservoirs to the proposed landfill, and because antidotal accounts of bald eagles in the vicinity have been reported, Horizon conducted focused site reconnaissance efforts for bald eagle nest sites on October 29, 2018 and February 12, 2019. The February 2019 reconnaissance was intensified during the primary eagle nesting season in Texas and when tree canopies are mostly leaf free providing the best visual observations. The proposed landfill footprint and buffer areas were thoroughly searched on foot by several Horizon biologists for eagle nests. No nests were observed. Additionally, no eagles have been observed to fly over the site during those survey events or during numerous other site reconnaissance efforts by Horizon biologists between 2017 and 2019.

The antidotal accounts of eagles near the landfill site purport there to be a "pair of eagles that nest on the site" and eagles foraging around the SCS reservoir #19. The intensive surveys for eagle nests on the landfill site did not locate a nest. Follow up communications with nearby landowners revealed that the eagle nest is actually located approximately 1.8 miles southwest of the landfill boundary. One landowner reported seeing eagles foraging and perching around SCS Reservoir #20 approximately 0.6 mile southwest of the landfill boundary. Horizon biologists were allowed access to the private property where the eagle nest is located. Upon arrival at the property, Horizon biologists observed an eagle nest in a large cottonwood tree with two mature eagles perching near the nest (see photo 6, Appendix B). In addition to the observed nest, the landowner also reported an historical nest approximately 800 feet northeast of the observed nest. Horizon biologists searched the indicated location of the historical nest but did not identify a remaining nest. The landowner requested that the City not disclose the location or the property ownership of the eagle nest.

To further document the absence of eagle nests on or near the landfill site, an additional site visit with a Texas Parks and Wildlife Department (TPWD) biologist was conducted on 11 December 2019. No eagle nests or eagles were observed during that site visit. Additionally, per suggestion of the TPWD biologist, a low-altitude drone survey was conducted on 20 January 2020. Video was produced of the flight. No eagle nests were observed in the drone video. No eagles were observed by biologists on the ground during the drone survey.

Interior Least Tern (state and federal lists)

The interior least tern is also migratory and nests along large bodies of water such as rivers or lakes where generally barren shorelines or sandbars exist. No such habitats exist on the subject site and this species would not be expected to occur there.

Piping Plover (federal list)

The piping plover is migratory and passes over much of Texas on its migration route. It winters on the Texas coast. It occupies coastal beaches, mud flats, and shorelines. The piping plover would not be expected on the landfill site.

Red Knot (federal list)

The red knot is migratory and passes over much of Texas on its migration route. It winters on the Texas coast. It occupies coastal beaches, mud flats, and shorelines. The red knot would not be expected on the landfill site.

Golden-cheeked Warbler (state and federal list)

Nests in juniper-oak woodlands in the western portion of McLennan County. It would be highly improbable for the golden-cheeked warbler to occur in eastern McLennan County or Limestone County. However, due to unconfirmed reports of golden-cheeks on nearby properties, Horizon conducted a USFWS protocol survey for golden-cheeks on March 27 and 29, April 10, 17, 26, and 29, and May 13, 28, and 29 of 2019 in all wooded areas of the proposed landfill site. These dates are within the nesting period for the golden-cheeked warbler in Central Texas when the bird is present in Texas. No golden-cheeked warblers were detected. The golden-cheeked warbler occurs along and west of the Edwards Plateau and would not be expected to occur on the landfill site.

White-faced Ibis (state list)

The white-faced ibis prefers freshwater marshes, sloughs, and irrigated rice fields. It nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats. The landfill site is upland with only ephemeral tributaries. The ibis would not be expected on the landfill site.

Wood Stork (state list)

The wood stork forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries). It breeds in Mexico and the birds move into Gulf States in search of mud flats and other wetlands. The landfill site is upland with only ephemeral tributaries. The wood stork would not be expected on the landfill site.

Mammals

Gray Wolf (state list)

Although the gray wolf is included on the state list of endangered mammals, the wolf is considered extirpated in the state.

Fishes

Smalleye Shiner (state List)

The smalleye shiner is endemic to the upper Brazos River system and its tributaries (Clear Fork and Bosque) and apparently introduced into the adjacent Colorado River drainage. The landfill site is upland with only ephemeral tributaries. The shiner would not be expected on the landfill site.

Sharpnose Shiner (state list)

The sharpnose shiner is endemic to the Brazos River watershed and has also apparently been introduced into the adjacent Colorado River drainage. It utilizes large turbid rivers with sand, gravel, and clay-mud bottom. The landfill site is upland with only ephemeral tributaries. The shiner would not be expected on the landfill site.

Mussels

Smooth Pimpleback (federal and state list)

Occurs in small to moderate streams and rivers as well as moderate size reservoirs with mixed mud, sand, and fine gravel. It tolerates very slow to moderate flow rates and appears not to tolerate dramatic water level fluctuations. The landfill site is upland with only ephemeral tributaries. The pimpleback would not be expected on the landfill site.

Texas Fawnsfoot (federal and state list)

Little is known about this species, but it possibly occurs in rivers and larger streams, and is intolerant of impoundments. Known from the Brazos and Colorado River basins. The landfill site is upland with only ephemeral tributaries. The fawnsfoot would not be expected on the landfill site.

Reptiles

Timber Rattlesnake (state list)

Occurs in swamps, floodplains, upland pine and deciduous woodlands, riparian zones, and abandoned farmland. It prefers dense ground cover such as grapevines or palmetto. There are potentially suitable habitat characteristics for this species in the bottomlands along Horse Creek. The proposed landfill area is upland with only ephemeral tributaries and minimal riparian areas. It is relatively unlikely that the timber rattlesnake would occur on the landfill site. No timber rattlesnakes have been observed on the site during various field reconnaissance efforts by Horizon biologists between 2017 and 2019. However, due to the general proximity to Horse Creek, the presence of the timber rattlesnake cannot be ruled out and a species management plan is included herein to minimize the potential effects to the timber rattlesnake. By implementing the species management plan, the facility and operation of the facility will not cause or contribute to the regulated taking of listed threatened or endangered species, including the timber rattlesnake if any are present on the site.

Texas Horned Lizard (state list)

The Texas horned lizard formerly occurred throughout most of Texas, but now is generally restricted to the western and southern two-thirds of the state. Its preferred habitat is open to semi-open grasslands and savannahs. Its primary food source is the harvester ant. The presence of these ants is a prerequisite for suitable horned lizard habitat. No horned lizards have been observed on the site during various field reconnaissance efforts by Horizon biologists between 2017 and 2019. While somewhat unlikely, the possible occurrence of the horned lizard on the subject site cannot be ruled out, particularly on the western disposal area and the northern portion of the eastern disposal area. A species management plan is included herein to minimize the potential effects to the horned lizard. By implementing the species management plan, the facility and operation of the facility will not cause or contribute to the regulated taking of listed threatened or endangered species, including the Texas horned lizard if any are present on the site.

Alligator Snapping Turtle (state list)

Occurs in perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers. All streams on the subject site are ephemeral and unlikely to support alligator snapping turtles.

Texas Garter Snake (state list)

The Texas garter snake is neither federally or state listed as threatened or endangered but is listed as a “species of greatest conservation need” (SGCN) by Texas Parks and Wildlife Department’s Natural Heritage Program. It occurs in wet or moist microhabitats but is not necessarily restricted to those habitats. The Texas garter hibernates underground or in or under surface cover. Documented occurrences of the Texas garter snake are known in the vicinity of the landfill project area. It could occur in and around the wetlands adjacent to the SCS reservoir although none of those microhabitats occur within the project footprint. While somewhat unlikely, the possible occurrence of the Texas garter snake on the subject site cannot be ruled out, particularly near Horse Creek and its tributaries. A species management plan is included herein to minimize the potential effects to the Texas garter snake. By implementing the species management plan, the facility and operation of the facility will not cause or contribute to the regulated taking of listed species of greatest conservation need, including the Texas garter snake if any are present on the site.

Plants

Navasota Ladies-tresses (federal and state list)

Occurs in sandy loams within openings in post oak woodlands along upland drainages or intermittent streams, often in areas with suitable hydrologic factors, such as a perched water table associated with the underlying claypan. This species is known to occur in eastern and southern Limestone County. It is unlikely to occur in northwestern Limestone County or on the subject site. Despite its unlikely occurrence on or near the landfill site, Horizon conducted a detailed survey of all potential habitat areas (along drainages in post oak woodlands) within the landfill footprint and buffer areas on October 29, 2018. The blooming period for Navasota ladies-tresses when the plant can be identified is October to early November. The majority of the survey area had unsuitable soil conditions (clay soils). No Navasota ladies-tresses or any other *Spiranthes* species were observed during the survey effort. The Navasota ladies-tresses is not likely to occur on the proposed landfill area.

CONSERVATION MEASURES

According to 30 Texas Administrative Code (TAC) 330.157 and 330.551, construction and operation of municipal solid waste landfill facilities in the State of Texas shall not result in adverse modification of the critical habitat of threatened or endangered (T/E) species, or cause or contribute to the taking of any T/E species. No federally-designated critical habitat is situated on or near the proposed landfill site. No federally-listed species are likely to occur on the site. Horizon has made a determination of “No Effect” for federally-listed species.

It is not unexpected that bald eagles may occur and forage from time to time around the SCS reservoir #19 adjacent to the landfill site. Bald eagles are delisted from the Endangered Species Act, but are still protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). The US Fish and Wildlife Service developed the National Bald Eagle Management Guidelines (Appendix D) to establish guidelines for private and non-federal property owners to minimize adverse effects to bald eagles. Page 12 of the guidelines provides minimum distance buffers from active nest sites for various types of land use or land development activity. Development and operation of a landfill would be commensurate with mining activities listed under Category B. The largest minimum distance buffer for Category B activities is 660 feet from active nests. The identified eagle nest is 1.8 miles away form the landfill property boundary and 1.9 miles from the closest disturbance boundary of the landfill.

To minimize disturbance of eagles during foraging, the guidelines recommend not locating facilities directly in the flight path between a nest site and a foraging site. The proposed landfill is opposite SCS Reservoir #19 from the identified nest site and not in the direct path. Additionally, the nearest landfill disturbance boundary to SCS Reservoir #19 is 650 feet or greater with a dense forest cover that would further minimize any potential disturbance of foraging eagles.

The landfill may choose to implement an avian vector management and control plan that includes various means of scaring birds (vultures, grackles, sea gulls, etc.) from the waste disposal areas. Scare tactics may include various noise generators, human activity, pyrotechnics, owl decoys, effigies, etc. As an additional measure to minimize disturbance or harassment of bald eagles that may land in the active landfill area, bird management personnel will be trained in the recognition of bald eagles and will be instructed to abate avian scare tactics until the eagles voluntarily leave the landfill site.

In the case of the occurrence of a state-listed species on a site for a proposed state-permitted activity such as a landfill, water reservoir, surface coal mine, or the like, the typical means of minimizing impacts to the species that is recommended by Texas Parks and Wildlife Department is through the formulation and implementation of a management plan for the species.

These plans can include several actions or management activities, depending on the species, but generally focus on education of project personnel to be observant and to recognize the species for avoidance of death or injury. In many cases, qualified and permitted biologists conduct detailed surveys for the species prior to clearing or grading to find and relocate as many of the individuals as possible to another suitable habitat area in proximity to the landfill site (not more than 1 mile away). These surveys may be conducted each year in as yet undisturbed areas of the project site scheduled for clearing, excavation, grading, etc. that year. If possible, favorable habitats for the species may be created, managed, or enhanced on an area away from the project site to increase the species available habitat. The collection and transport of any state-listed species must be done under a State Scientific Collection Permit specific to that species. A management plan for the timber rattlesnake, Texas horned lizard, and Texas garter snake on the proposed landfill site is found in the next section of this report.

Implementation of a management plan will ensure that the development and operation of the landfill will not cause or contribute to a regulated taking of endangered or threatened species and identified species of greatest conservation need because pursuing, hunting, wounding, trapping, capturing, and collecting are intentional acts that will be prohibited by the plan. The disruption of normal behavior patterns (harassing) will not occur because significant undeveloped areas exist nearby, within and off the site. Additionally, an "act of omission" that actually kills or injures wildlife (harming) will not occur because the management plan will provide specific actions to be taken to minimize impacts to the species consistent with recommendations of TPWD for state-permitted facilities.

No timber rattlesnakes or Texas horned lizards have thus far been observed during field reconnaissance efforts on the proposed landfill site. However, the possibility of their occurrence cannot be ruled out. In order to minimize potential impacts and to demonstrate compliance with regulatory requirements, the City of Waco will implement the following protection and management activities for these species.

MANAGEMENT PLAN

Prohibited Actions

Persons at the proposed landfill facility shall not annoy, pursue, hunt, wound, trap, capture or collect any timber rattlesnakes, Texas garter snakes, or Texas horned lizards that may be present at the facility except for capturing for purposes of relocation as authorized by this plan and a State Scientific Collection Permit.

Survey/Inspection/Relocation

Prior to land clearing, excavation or other disruptive activities on undeveloped areas of the site, the City of Waco will implement a search and removal/relocation survey of the area to be impacted. The surveys will occur no more than 6 months prior to land clearing, excavation, etc. A biologist with a State Scientific Collection Permit will conduct the surveys. Additional field assistants will be utilized as needed under the direct supervision of the State permitted biologist. Surveys will be pedestrian-style ground surveys conducted during the season when the listed reptile species are active. Surveys will consist of meandering transects in which logs, plant material, and debris are overturned in an effort to locate listed species. All individuals of these species encountered and captured will be relocated to suitable habitat off the landfill area but in close proximity (less than 1 mile). All observed and/or translocated state listed species will be reported to Texas Parks and Wildlife Department and the Texas Natural Diversity Database according to data submittal requirements. Additionally, the City will inspect all open trenches before start of landfill activities each day to ensure that no endangered or threatened wildlife are trapped in the trenches.

Conclusion

All of the state or federally listed threatened or endangered species were reviewed for possible impact by the proposed landfill operations. The site is not in an area designated as critical habitat for any listed threatened or endangered species, nor does the site provide suitable habitat for any federally-listed species. Bald eagles may occur from time to time around the adjacent SCS Reservoir #19 for foraging. The proposed landfill is sufficiently distant from the reservoir to minimize disturbance or harassment of foraging eagles. Avian management personnel will be trained to recognize bald eagles and abate avian scare tactics if bald eagles land in the active landfill area. Three state-listed species, the timber rattlesnake, Texas garter snake, and Texas horned lizard may occur in or near the landfill site; however, none of the species have been observed on the landfill site. A species management plan is included herein and will be implemented by the City of Waco to ensure that construction and operation the municipal solid waste landfill and associated facilities will not result in adverse modification of the critical habitat of any threatened or endangered species, or cause or contribute to the taking of any listed species.

MIGRATORY BIRDS

Nearly all birds are migratory. Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) from intentional acts of death or injury, or possession of the birds or their parts or nests. This migratory bird management plan includes a number of recommended actions to prevent migratory birds from nesting in active development zones on the project as well as voluntary conservation elements for migratory birds, including scheduling of clearing activities to avoid major nesting periods, avoidance of any observed active nests where possible, power line construction according to guidelines for prevention of impacts to raptors, and covering of ponds or pits that may contain any hazardous materials.

The Migratory Bird Treaty Act (USC 16 § 703) and the Texas Parks and Wildlife Code (TPWC § 63) provide for the protection of all bird species considered to be migratory by the U.S. Fish and Wildlife Service (FWS) and the Texas Parks and Wildlife Department (TPWD). This includes all birds except European starlings, English sparrows, ring-necked doves, ravens (but not crows), and feral pigeons. Protection is afforded to prevent intentional death or injury, capture, possession, transport, or sale of individuals of the species, dead or alive, including their parts, eggs and nests.

On December 22, 2017 the Office of the Solicitor for the U.S. Department of the Interior (DOI) issued a memorandum (M-37050) (Attachment A) clarifying take of migratory birds under the MBTA to not include incidental or accidental take resulting from an action or activity which purpose is not intentionally to take or possess migratory birds, their parts, or nests. Under this clarification, incidental take of migratory birds associated with activities such as land clearing, construction activities, operation and maintenance of facilities, etc. is not prohibited by the MBTA.

Therefore, under this interpretation by the DOI Solicitor, construction or operational activities in the normal course of developing and operating the landfill project need not be suspended or modified to avoid incidental or accidental take of migratory bird nests that may occur on the site. That being said, implementing voluntary measures to minimize take of migratory birds where practicable is an appropriate and responsible thing to do. In that light, preventing nest development within the active construction zone or on equipment is the best approach to minimizing impacts to bird nests.

Prevention of Nesting in Active Development Zones

Since most migratory birds are highly mobile as adults, death or injury as an incidental occurrence to land disturbance activities is not likely. The principal concern is nests, eggs, or fledglings that might be destroyed during land development activities during the nesting season. The primary protection strategy is to prevent nesting to the extent practicable during the nesting season in areas likely to experience construction or operational activity. In most of Texas, the primary season for nesting and fledging is March 1 to June 1, but some hawks, owls, and other larger birds may nest earlier (December to March). After June 1st, only sporadic late nesting occurs until August.

On large construction sites such as the landfill, expansive bare ground areas, roads, and parking lots with aggregate surfaces are attractive nesting sites for many ground-nesting birds such as killdeer, nighthawks, etc. Large equipment such as bull dozers, loaders, etc. that sit idle for periods of time may also be attractive nest sites for doves and other birds. The key to prevention is frequent noise, activity, and disturbance within potential nesting areas. For large bare ground areas and parking lots traversing the areas once or twice daily in a vehicle or on foot will help dissuade birds from establishing nests. Around large equipment that is idle, starting and moving frequently will help. If that is not practicable on a regular basis, then creating noise and activity such as with noise makers may help. Owl decoys may be placed on equipment as well. Noise making equipment such as whistlers, bangers, pyrotechnics, etc. are frequently used in landfills to scare birds away and can be effective for short periods. However, birds may become accustomed to automated scare tactics, therefore, periodic changes to the tactic used is advisable.

Actions to Avoid Existing Nests Should They Occur

While incidental or accidental destruction of established nests is not a regulated activity under the Solicitor's recent opinion, to the extent reasonably practicable without undue work stoppage or modification, active bird nests can be allowed to exist until the fledglings have left the nest. Establishment of a no-disturbance zone around an active nest of 30 feet ± diameter is usually adequate depending on the type and intensity of activity occurring in the vicinity.

If an active nest is discovered in an area that cannot be avoided or on equipment that needs to be activated prior to the completion of nesting, then the construction activity can proceed. There should not be a direct intentional attempt to move or destroy the nest, but if the nest is destroyed or abandoned in the normal course of conducting the construction activity, that is not regulated.

New clearing or grubbing of land for landfill development should be conducted outside of the primary nesting season if possible.

To the extent feasible, preclusion of access by wildlife or birds to any pits or tanks containing potential toxic-forming materials by fencing, covering, or otherwise discouraging use of these areas by wildlife should be implemented.

Construction or marking of power lines within the site in a manner consistent with recommendations from the USFWS and TPWD to avoid or minimize the potential for strikes or electrocution by large raptors is also advisable (Appendix E). If any large communication towers are constructed by others in the future on the site which is owned or controlled by the City, the owner or operator of the tower should be advised to construct and light the tower in accordance with guidelines for minimizing impacts to migratory birds.

Please call if you have any questions.

Sincerely,

C. Lee Sherrod

C. Lee Sherrod
Senior Project Manager

APPENDIX A

FIGURES

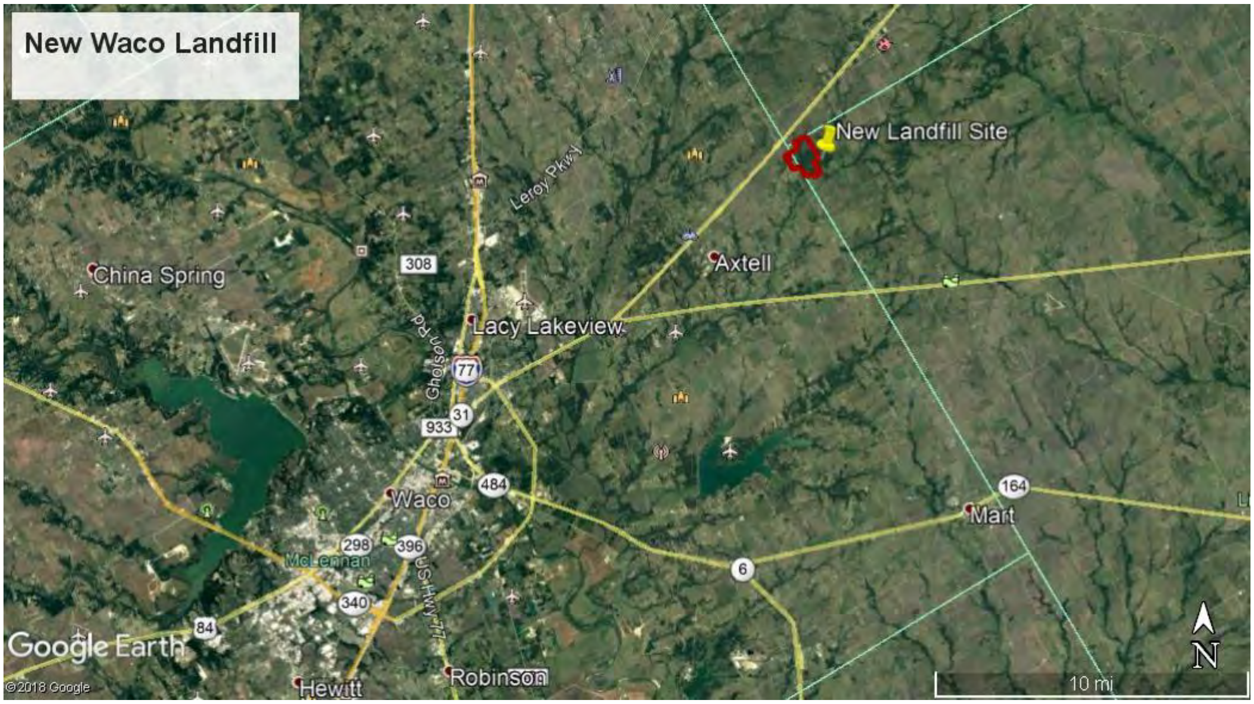

FIGURE 1: LOCATION

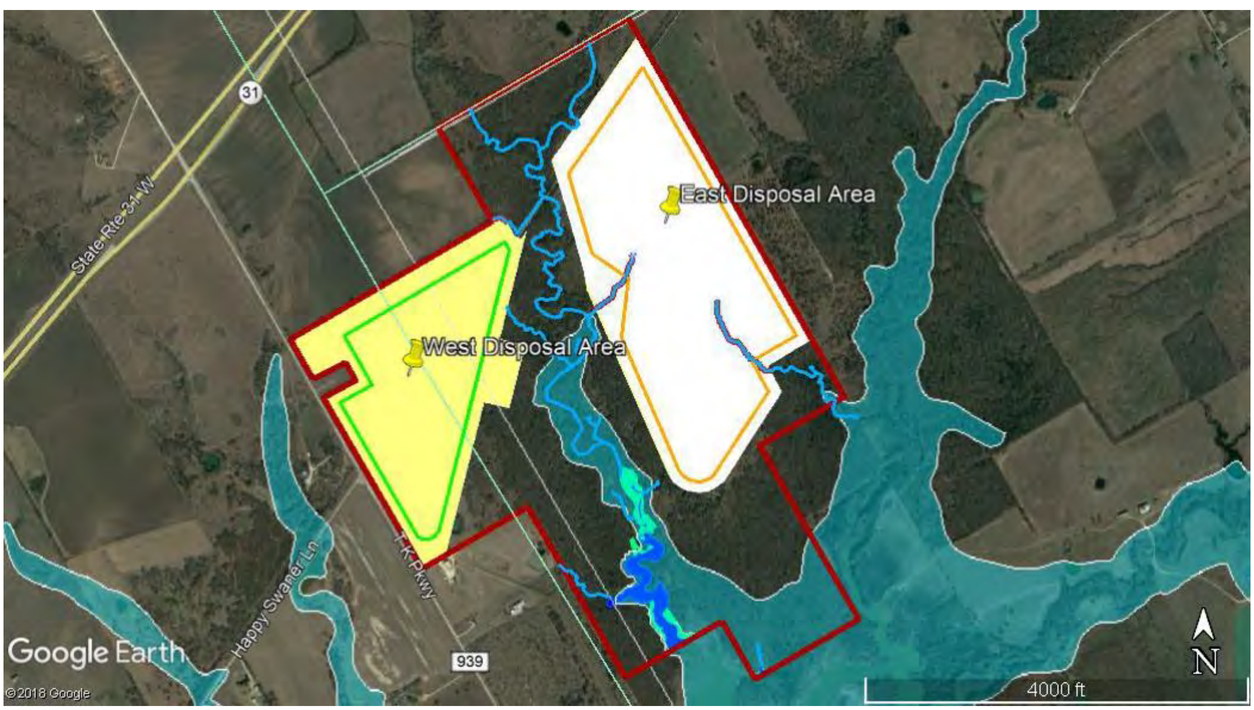

FIGURE 2: SITE CHARACTERISTICS SHOWING LANDFILL FOOTPRINT, FLOODPLAIN, TRIBUTARIES, WETLANDS, AND OPEN WATER

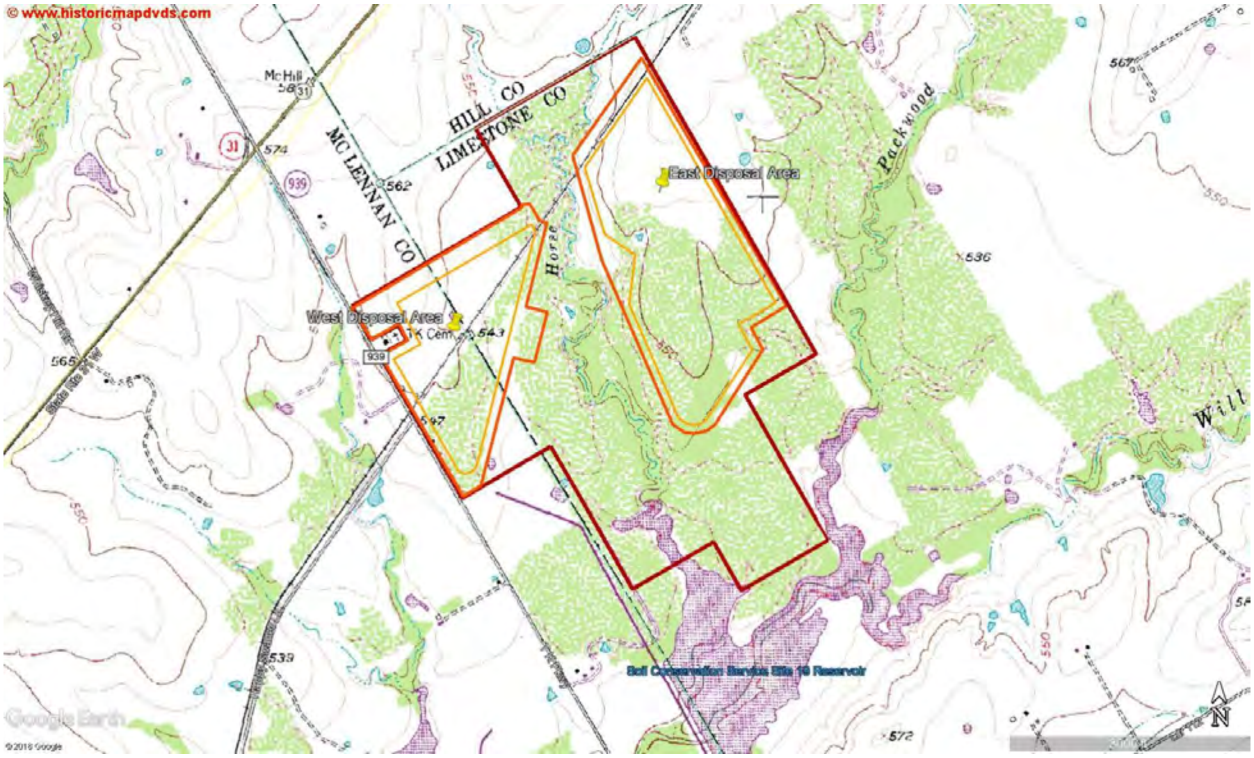

FIGURE 3: TOPO MAP

APPENDIX B

ONSITE PHOTOGRAPHS

PHOTO 1
Upland Woodland

PHOTO 2
Riparian Woodland

PHOTO 3
Horse Creek

PHOTO 4
Horse Creek

PHOTO 5
Tributary of Horse Creek to be Impacted

PHOTO 6
Bald Eagle Nest 1.8 Miles Southwest of Landfill Site

APPENDIX C

STATE AND FEDERAL SPECIES LISTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 El Camino Real #211
Houston, TX 77058
Phone: (281) 286-8282 Fax: (281) 488-5882
http://www.fws.gov/southwest/es/TexasCoastal/
http://www.fws.gov/southwest/es/ES_Lists_Main2.html

In Reply Refer To: July 15, 2018
Consultation Code: 02ETTX00-2018-SLI-1957
Event Code: 02ETTX00-2018-E-04079
Project Name: New Waco LF

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; P.O. Box 81468; Corpus Christi, Texas 78468-1468. For projects located in six counties in southern Texas (Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata) please write: Santa Ana NWR, ATTN: Ecological Services Sub Office, 3325 Green Jay Road, Alamo, Texas 78516.

The enclosed species list identifies federally threatened, endangered, and proposed to be listed species; designated critical habitat; and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project.

New information from updated surveys, changes in the abundance and distribution of species, changes in habitat conditions, or other factors could change the list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation for updates to species list and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Candidate species have no protection under the Act but are included for consideration because they could be listed prior to the completion of your project. The other species information should help you determine if suitable habitat for these listed species exists in any of the proposed project areas or if project activities may affect species on-site, off-site, and/or result in "take" of a federally listed species.

"Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if the activity results in the death or injury of wildlife by removing essential habitat components or significantly alters essential behavior patterns, including breeding, feeding, or sheltering.

Section 7

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species. If a "may affect" determination is made, the Federal agency shall initiate the section 7 consultation process by writing to the office that has responsibility for the area in which your project occurs.

Is not likely to adversely affect - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect - adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires the Federal action agency to initiate formal section 7 consultation with this office.

No effect - the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No further coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related articles.

Please be advised that while a Federal agency may designate a non-Federal representative to conduct informal consultations with the Service, assess project effects, or prepare a biological assessment, the Federal agency must notify the Service in writing of such a designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Act requirements for your projects at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Section 10

If there is no federal involvement and the proposed project is being funded or carried out by private interests and/or non-federal government agencies, and the project as proposed may affect listed species, a section 10(a)(1)(B) permit is recommended. The Habitat Conservation Planning Handbook is available at: http://www.fws.gov/endangered/esa-library/pdf/HCP_Handbook.pdf

Service Response

Please note that the Service strives to respond to requests for project review within 30 days of receipt, however, this time period is not mandated by regulation. Responses may be delayed due to workload and lack of staff. Failure to meet the 30-day timeframe does not constitute a concurrence from the Service that the proposed project will not have impacts to threatened and endangered species.

Proposed Species and/or Proposed Critical Habitat

While consultations are required when the proposed action may affect listed species, section 7(a)(4) was added to the ESA to provide a mechanism for identifying and resolving potential conflicts between a proposed action and proposed species or proposed critical habitat at an early planning stage. The action agency should seek conference from the Service to assist the action agency in determining effects and to advise the agency on ways to avoid or minimize adverse effect to proposed species or proposed critical habitat.

Candidate Species

Candidate species are species that are being considered for possible addition to the threatened and endangered species list. They currently have no legal protection under the ESA. If you find you have potential project impacts to these species the Service would like to provide technical assistance to help avoid or minimize adverse effects. Addressing potential impacts to these species at this stage could better provide for overall ecosystem healh in the local area and ay avert potential future listing.

Several species of freshwater mussels occur in Texas and four are candidates for listing under the ESA. The Service is also reviewing the status of six other species for potential listing under the ESA. One of the main contributors to mussel die offs is sedimentation, which smothers and suffocates mussels. To reduce sedimentation within rivers, streams, and tributaries crossed by a project, the Service recommends that that you implement the best management practices found at: http://www.fws.gov/southwest/es/TexasCoastal/FreshwaterMussels.html.

Candidate Conservation Agreements (CCAs) or Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements between the Service and public or private entities to implement conservation measures to address threats to candidate species. Implementing conservation efforts before species are listed increases the likelihood that simpler, flexible, and more cost-effective conservation options are available. A CCAA can provide participants with assurances that if they engage in conservation actions, they will not be required to implement additional conservation measures beyond those in the agreement. For additional information on CCAs/CCAAs please visit the Service's website at http://www.fws.gov/endangered/what-we-do/cca.html.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Many may nest in trees, brush areas or other suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals or eggs. If project activities must be conducted during this time, we recommend surveying for active nests prior to commencing work. A list of migratory birds may be viewed at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the Act on August 9, 2007. Both the bald eagle and the goden eagle (*Aquila chrysaetos*) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For more information on bald and golden eagle management guidlines, we recommend you review information provided at http://www.fws.gov/midwest/eagle/pdf/NationalBaldEagleManagementGuidelines.pdf.

The construction of overhead power lines creates threats of avian collision and electrocution. The Service recommends the installation of underground rather than overhead power lines whenever possible. For new overhead lines or retrofitting of old lines, we recommend that project developers implement, to the maximum extent practicable, the Avian Power Line Interaction Committee guidelines found at http://www.aplic.org/.

Meteorological and communication towers are estimated to kill millions of birds per year. We recommend following the guidance set forth in the Service Interim Guidelines for Recommendations on Communications Tower Siting, Constructions, Operation and Decommissioning, found online at: http://www.fws.gov/habitatconservation/communicationtowers.html, to minimize the threat of avian mortality at these towers. Monitoring at these towers would provide insight into the effectiveness of the minimization measures. We request the results of any wildlife mortality monitoring at towers associated with this project.

We request that you provide us with the final location and specifications of your proposed towers, as well as the recommendations implemented. A Tower Site Evaluation Form is also available via the above website; we recommend you complete this form and keep it in your files. If meteorological towers are to be constructed, please forward this completed form to our office.

More information concerning sections 7 and 10 of the Act, migratory birds, candidate species, and landowner tools can be found on our website at: http://www.fws.gov/southwest/es/TexasCoastal/ProjectReviews.html.

Wetlands and Wildlife Habitat

Wetlands and riparian zones provide valuable fish and wildlife habitat as well as contribute to flood control, water quality enhancement, and groundwater recharge. Wetland and riparian vegetation provides food and cover for wildlife, stabilizes banks and decreases soil erosion. These areas are inherently dynamic and very sensitive to changes caused by such activities as overgrazing, logging, major construction, or earth disturbance. Executive Order 11990 asserts that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities. Construction activities near riparian zones should be carefully designed to minimize impacts. If vegetation clearing is needed in these riparian areas, they should be re-vegetated with native wetland and riparian vegetation to prevent erosion or loss of habitat. We recommend minimizing the area of soil scarification and initiating incremental re-establishment of herbaceous vegetation at the proposed work sites. Denuded and/or disturbed areas should be re-vegetated with a mixture of native legumes and grasses. Species commonly used for soil stabilization are listed in the Texas Department of Agriculture's (TDA) Native Tree and Plant Directory, available from TDA at P.O. Box 12847, Austin, Texas 78711. The Service also urges taking precautions to ensure sediment loading does not occur to any receiving streams in the proposed project area. To prevent and/or minimize soil erosion and compaction associated with construction activities, avoid any unnecessary clearing of vegetation, and follow established rights-of-way whenever possible. All machinery and petroleum products should be stored outside the floodplain and/or wetland area during construction to prevent possible contamination of water and soils.

Wetlands and riparian areas are high priority fish and wildlife habitat, serving as important sources of food, cover, and shelter for numerous species of resident and migratory wildlife. Waterfowl and other migratory birds use wetlands and riparian corridors as stopover, feeding, and nesting areas. We strongly recommend that the selected project site not impact wetlands and riparian areas, and be located as far as practical from these areas. Migratory birds tend to concentrate in or near wetlands and riparian areas and use these areas as migratory flyways or corridors. After every effort has been made to avoid impacting wetlands, you anticipate unavoidable wetland impacts will occur; you should contact the appropriate U.S. Army Corps of Engineers office to determine if a permit is necessary prior to commencement of construction activities.

If your project will involve filling, dredging, or trenching of a wetland or riparian area it may require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (COE). For permitting requirements please contact the U.S. Corps of Engineers, District Engineer, P.O. Box 1229, Galveston, Texas 77553-1229, (409) 766-3002.

Beneficial Landscaping

In accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (42 C.F.R. 26961), where possible, any landscaping associated with project plans should be limited to seeding and replanting with native species. A mixture of grasses and forbs appropriate to address potential erosion problems and long-term cover should be planted when seed is reasonably available. Although Bermuda grass is listed in seed mixtures, this species and other introduced species should be avoided as much as possible. The Service also recommends the use of native trees, shrubs, and herbaceous species that are adaptable, drought tolerant and conserve water.

State Listed Species

The State of Texas protects certain species. Please contact the Texas Parks and Wildlife Department (Endangered Resources Branch), 4200 Smith School Road, Austin, Texas 78744 (telephone 512/389-8021) for information concerning fish, wildlife, and plants of State concern or visit their website at: http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/.

If we can be of further assistance, or if you have any questions about these comments, please contact 281/286-8282 if your project is in southeast Texas, or 361/994-9005, ext. 246, if your project is in southern Texas. Please refer to the Service consultation number listed above in any future correspondence regarding this project.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Texas Coastal Ecological Services Field Office
17629 El Camino Real #211
Houston, TX 77058
(281) 286-8282

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
(512) 490-0057

Project Summary

Consultation Code: 02ETTX00-2018-SLI-1957

Event Code: 02ETTX00-2018-E-04079

Project Name: New Waco LF

Project Type: Landfill

Project Description: New landfill

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/31.702514752419994N96.92286119351184W

Counties: Limestone, TX | McLennan, TX

Endangered Species Act Species

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Least Tern *Sterna antillarum* Population: interior pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location is outside the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Clams

NAME	STATUS
Smooth Pimpleback *Quadrula houstonensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8967	Candidate
Texas Fawnsfoot *Truncilla macrodon* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8965	Candidate

Flowering Plants

NAME	STATUS
Navasota Ladies'-tresses *Spiranthes parksii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1570	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
Phone: (512) 490-0057 Fax: (512) 490-0974
http://www.fws.gov/southwest/es/AustinTexas/
http://www.fws.gov/southwest/es/EndangeredSpecies/lists/

In Reply Refer To: July 15, 2018
Consultation Code: 02ETAU00-2018-SLI-1221
Event Code: 02ETAU00-2018-E-02397
Project Name: New Waco LF

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that *may* occur within the county of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Please note that new information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Also note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq*.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of federally listed as threatened or endangered species and to determine whether projects may affect these species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

While a Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment, the Federal Agency must notify the Service in writing of any such designation. The Federal agency shall also independently review and evaluate the scope and content of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by a federally funded, permitted or authorized activity, the agency is required to consult with the Service pursuant to 50 CFR 402. The following definitions are provided to assist you in reaching a determination:

- *No effect* - the proposed action will not affect federally listed species or critical habitat. A “no effect” determination does not require section 7 consultation and no coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.
- *May affect, but is not likely to adversely affect* - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effect. The Federal agency or the designated non-Federal representative should consult with the Service to seek written concurrence that adverse effects are not likely. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.
- *Is likely to adversely affect* - adverse effects to listed species may occur as a direct or indirect result of the proposed action. For this determination, the effect of the action is neither discountable nor insignificant. If the overall effect of the proposed action is beneficial to the listed species but the action is also likely to cause some adverse effects to individuals of that species, then the proposed action “is likely to adversely affect” the listed species. The analysis should consider all interrelated and interdependent actions. An “is likely to adversely affect” determination requires the Federal action agency to initiate formal section 7 consultation with our office.

Regardless of the determination, the Service recommends that the Federal agency maintain a complete record of the evaluation, including steps leading to the determination of effect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related information. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF.

Migratory Birds

For projects that may affect migratory birds, the Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of these species. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Migratory birds may nest in trees, brushy areas, or other areas of suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals, nests, or eggs. If project activities must be conducted during this time, we recommend surveying for nests prior to conducting work. If a nest is found, and if possible, the Service recommends a buffer of vegetation remain around the nest until the young have fledged or the nest is abandoned.

For additional information concerning the MBTA and recommendations to reduce impacts to migratory birds please contact the U.S. Fish and Wildlife Service Migratory Birds Office, 500 Gold Ave. SW, Albuquerque, NM 87102. A list of migratory birds may be viewed at https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php. Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at: https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/communication-towers.php. Additionally, wind energy projects should follow the wind energy guidelines

https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/wind-energy.php) for minimizing impacts to migratory birds and bats.

Finally, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents/eagles.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

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10711 Burnet Road, Suite 200
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Texas Coastal Ecological Services Field Office
17629 El Camino Real #211
Houston, TX 77058
(281) 286-8282

Project Summary

Consultation Code: 02ETAU00-2018-SLI-1221

Event Code: 02ETAU00-2018-E-02397

Project Name: New Waco LF

Project Type: Landfill

Project Description: New landfill

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/31.702514752419994N96.92286119351184W

Counties: Limestone, TX | McLennan, TX

Endangered Species Act Species

There is a total of 7 threatened, endangered, or candidate species on this species list.

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See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Golden-cheeked Warbler (=wood) *Dendroica chrysoparia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/33	Endangered
Least Tern *Sterna antillarum* Population: interior pop. No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location is outside the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Clams

NAME	STATUS
Smooth Pimpleback *Quadrula houstonensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8967	Candidate
Texas Fawnsfoot *Truncilla macrodon* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8965	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Last Revision: 5/16/2016 5:47:00 PM

LIMESTONE COUNTY

BIRDS		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow	*Ammodramus henslowii*		

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Interior Least Tern	*Sterna antillarum athalassos*	LE	E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Peregrine Falcon	*Falco peregrinus*	DL	T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Red Knot	*Calidris canutus rufa*	T	

Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. A small plump-bodied, short-necked shorebird that in breeding plumage, typically held from May through August, is a distinctive and unique pottery orange color. Its bill is dark, straight and, relative to other shorebirds, short-to-medium in length. After molting in late summer, this species is in a drab gray-and-white non-breeding plumage, typically held from September through April. In the non-breeding plumage, the knot might be confused with the omnipresent Sanderling. During this plumage, look for the knot's prominent pale eyebrow and whitish flanks with dark barring. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primary prey items include coquina clam (Donax spp.) on beaches and dwarf surf clam (Mulinia lateralis) in bays, at least in the Laguna Madre. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore.

Sprague's Pipit	*Anthus spragueii*		

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

Western Burrowing Owl	*Athene cunicularia hypugaea*		

open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

White-faced Ibis	*Plegadis chihi*		T

prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats

Whooping Crane	*Grus americana*	LE	E

potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties

Wood Stork	*Mycteria americana*		T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

	FISHES	Federal Status	State Status
Smalleye shiner	*Notropis buccula*	LE	

endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates

	MAMMALS	Federal Status	State Status
Plains spotted skunk	*Spilogale putorius interrupta*		

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf	*Canis rufus*	LE	E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

	MOLLUSKS	Federal Status	State Status
Smooth pimpleback	*Quadrula houstonensis*	C	T

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Texas fawnsfoot	*Truncilla macrodon*	C	T

little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins

REPTILES

		Federal Status	State Status
Alligator snapping turtle	*Macrochelys temminckii*		T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

Texas garter snake *Thamnophis sirtalis annectens*

wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August

Texas horned lizard	*Phrynosoma cornutum*		T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

Timber rattlesnake	*Crotalus horridus*		T

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS

		Federal Status	State Status
Goldenwave tickseed	*Coreopsis intermedia*		

GLOBAL RANK: G3; In deep sandy soils of sandhills in openings in or along margins of post oak woodlands and pine-oak forests of east Texas; Perennial; Flowering/Fruiting May-Aug

Navasota ladies'-tresses	*Spiranthes parksii*	LE	E

Texas endemic; openings in post oak woodlands in sandy loams along upland drainages or intermittent streams, often in areas with suitable hydrologic factors, such as a perched water table associated with the underlying claypan; flowering populations fluctuate widely from year to year, an individual plant does not flower every year; flowering late October-early November (-early December)

Small-headed pipewort *Eriocaulon koernickianum*

in East Texas, post-oak woodlands and xeric sandhill openings on permanently wet acid sands of upland seeps and hillside seepage bogs, usually in patches of bare sand rather than among dense vegetation or on muck; in Gillespie County, on permanently wet or moist hillside seep on decomposing granite gravel and sand among granite outcrops; flowering/fruiting late May-late June

Texas sandmint *Rhododon ciliatus*

GLOBAL RANK: G3; Open sandy areas in the Post Oak Belt of east-central Texas; Annual; Flowering April-Aug; Fruiting May-Aug

Last Revision: 5/16/2016 5:47:00 PM

MCLENNAN COUNTY

BIRDS		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Golden-cheeked Warbler	*Setophaga chrysoparia*	LE	E

juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer

Henslow's Sparrow	*Ammodramus henslowii*		

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Interior Least Tern	*Sterna antillarum athalassos*	LE	E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Peregrine Falcon	*Falco peregrinus*	DL	T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Red Knot	*Calidris canutus rufa*	T	

Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. A small plump-bodied, short-necked shorebird that in breeding plumage, typically held from May through August, is a distinctive and unique pottery orange color. Its bill is dark, straight and, relative to other shorebirds, short-to-medium in length. After molting in late summer, this species is in a drab gray-and-white non-breeding plumage, typically held from September through April. In the non-breeding plumage, the knot might be confused with the omnipresent Sanderling. During this plumage, look for the knot's prominent pale eyebrow and whitish flanks with dark barring. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Primary prey items include coquina clam (Donax spp.) on beaches and dwarf surf clam (Mulinia lateralis) in bays, at least in the Laguna Madre. Wintering Range includes- Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kennedy, Kleberg, Matagorda, Nueces, San Patricio, and Willacy. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore.

Sprague's Pipit *Anthus spragueii*

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

Western Burrowing Owl *Athene cunicularia hypugaea*

open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

White-faced Ibis *Plegadis chihi* T

prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats

Whooping Crane *Grus americana* LE E

potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties

Wood Stork *Mycteria americana* T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

FISHES
Federal Status State Status

Guadalupe bass *Micropterus treculii*

endemic to perennial streams of the Edward's Plateau region; introduced in Nueces River system

Sharpnose shiner *Notropis oxyrhynchus* LE

endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud

Smalleye shiner *Notropis buccula* LE

endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates

MAMMALS
Federal Status State Status

Cave myotis bat *Myotis velifer*

colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore

Plains spotted skunk *Spilogale putorius interrupta*

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf *Canis rufus* LE E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

MOLLUSKS Federal Status State Status

Smooth pimpleback *Quadrula houstonensis* C T

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Texas fawnsfoot *Truncilla macrodon* C T

little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins

REPTILES Federal Status State Status

Texas garter snake *Thamnophis sirtalis annectens*

wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August

Texas horned lizard *Phrynosoma cornutum* T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

Timber rattlesnake *Crotalus horridus* T

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS Federal Status State Status

Plateau milkvine *Matelea edwardsensis*

GLOBAL RANK: G3 ; Occurs in various types of juniper-oak and oak-juniper woodlands; Perennial; Flowering March-Oct; Fruiting May-June

Texas milk vetch *Astragalus reflexus*

GLOBAL RANK: G3; Grasslands, prairies, and roadsides on calcareous and clay substrates; Annual; Flowering Feb-June; Fruiting April-June

Tree dodder *Cuscuta exaltata*

GLOBAL RANK: G3; Parasitic on various Quercus, Juglans, Rhus, Vitis, Ulmus, and Diospyros species as well as Acacia berlandieri and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct

APPENDIX D

NATIONAL BALD EAGLE MANAGEMENT GUIDELINES

NATIONAL BALD EAGLE MANAGEMENT GUIDELINES

U.S. Fish and Wildlife Service

May 2007

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INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) is protected by the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The MBTA and the Eagle Act protect bald eagles from a variety of harmful actions and impacts. The U.S. Fish and Wildlife Service (Service) developed these National Bald Eagle Management Guidelines to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. A variety of human activities can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young. The Guidelines are intended to help people minimize such impacts to bald eagles, particularly where they may constitute "disturbance," which is prohibited by the Eagle Act.

The Guidelines are intended to:

(1) Publicize the provisions of the Eagle Act that continue to protect bald eagles, in order to reduce the possibility that people will violate the law,

(2) Advise landowners, land managers and the general public of the potential for various human activities to disturb bald eagles, and

(3) Encourage additional nonbinding land management practices that benefit bald eagles (see Additional Recommendations section).

While the Guidelines include general recommendations for land management practices that will benefit bald eagles, the document is intended primarily as a tool for landowners and planners who seek information and recommendations regarding how to avoid disturbing bald eagles. Many States and some tribal entities have developed state-specific management plans, regulations, and/or guidance for landowners and land managers to protect and enhance bald eagle habitat, and we encourage the continued development and use of these planning tools to benefit bald eagles.

Adherence to the Guidelines herein will benefit individuals, agencies, organizations, and companies by helping them avoid violations of the law. However, the Guidelines themselves are not law. Rather, they are recommendations based on several decades of behavioral observations, science, and conservation measures to avoid or minimize adverse impacts to bald eagles.

The U.S. Fish and Wildlife Service strongly encourages adherence to these guidelines to ensure that bald and golden eagle populations will continue to be sustained. The Service realizes there may be impacts to some birds even if all reasonable measures are taken to avoid such impacts. Although it is not possible to absolve individuals and entities from liability under the Eagle Act or the MBTA, the Service exercises enforcement discretion to focus on those individuals, companies, or agencies that take migratory birds without regard for the consequences of their actions and the law, especially when conservation measures, such as these Guidelines, are available, but have not been implemented. The Service will prioritize its enforcement efforts to focus on those individuals or entities who take bald eagles or their parts, eggs, or nests without implementing appropriate measures recommended by the Guidelines.

The Service intends to pursue the development of regulations that would authorize, under limited circumstances, the use of permits if "take" of an eagle is anticipated but unavoidable. Additionally, if the bald eagle is delisted, the Service intends to provide a regulatory mechanism to honor existing (take) authorizations under the Endangered Species Act (ESA).

During the interim period until the Service completes a rulemaking for permits under the Eagle Act, the Service does not intend to refer for prosecution the incidental "*take*" of any bald eagle under the MBTA or Eagle Act, if such take is in full compliance with the terms and conditions of an incidental take statement issued to the action agency or applicant under the authority of section 7(b)(4) of the ESA or a permit issued under the authority of section 10(a)(1)(B) of the ESA.

The Guidelines are applicable throughout the United States, including Alaska. The primary purpose of these Guidelines is to provide information that will minimize or prevent violations only of *Federal* laws governing bald eagles. In addition to Federal laws, many states and some smaller jurisdictions and tribes have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines. If you are planning activities that may affect bald eagles, we therefore recommend that you contact both your nearest U.S. Fish and Wildlife Service Field Office (see the contact information on p.16) and your state wildlife agency for assistance.

LEGAL PROTECTIONS FOR THE BALD EAGLE

The Bald and Golden Eagle Protection Act

The Eagle Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb'' means:

> "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

A violation of the Act can result in a criminal fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

The Migratory Bird Treaty Act
The MBTA (16 U.S.C. 703-712), prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover bald eagles and other raptors. Implementing regulations define “take” under the MBTA as “pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect.”

Copies of the Eagle Act and the MBTA are available at: http://permits.fws.gov/ltr/ltr.shtml.

State laws and regulations
Most states have their own regulations and/or guidelines for bald eagle management. Some states may continue to list the bald eagle as endangered, threatened, or of special concern. If you plan activities that may affect bald eagles, we urge you to familiarize yourself with the regulations and/or guidelines that apply to bald eagles in your state. Your adherence to the Guidelines herein does not ensure that you are in compliance with state laws and regulations because state regulations can be more specific and/or restrictive than these Guidelines.

NATURAL HISTORY OF THE BALD EAGLE

Bald eagles are a North American species that historically occurred throughout the contiguous United States and Alaska. After severely declining in the lower 48 States between the 1870s and the 1970s, bald eagles have rebounded and re-established breeding territories in each of the lower 48 states. The largest North American breeding populations are in Alaska and Canada, but there are also significant bald eagle populations in Florida, the Pacific Northwest, the Greater Yellowstone area, the Great Lakes states, and the Chesapeake Bay region. Bald eagle distribution varies seasonally. Bald eagles that nest in southern latitudes frequently move northward in late spring and early summer, often summering as far north as Canada. Most eagles that breed at northern latitudes migrate southward during winter, or to coastal areas where waters remain unfrozen. Migrants frequently concentrate in large numbers at sites where food is abundant and they often roost together communally. In some cases, concentration areas are used year-round: in summer by southern eagles and in winter by northern eagles.

Juvenile bald eagles have mottled brown and white plumage, gradually acquiring their dark brown body and distinctive white head and tail as they mature. Bald eagles generally attain adult plumage by 5 years of age. Most are capable of breeding at 4 or 5 years of age, but in healthy populations they may not start breeding until much older. Bald eagles may live 15 to 25 years in the wild. Adults weigh 8 to 14 pounds (occasionally reaching 16 pounds in Alaska) and have wingspans of 5 to 8 feet. Those in the northern range are larger than those in the south, and females are larger than males.

Where do bald eagles nest?

Breeding bald eagles occupy “territories,” areas they will typically defend against intrusion by other eagles. In addition to the active nest, a territory may include one or more alternate nests (nests built or maintained by the eagles but not used for nesting in a given year). The Eagle Act prohibits removal or destruction of both active and alternate bald eagle nests. Bald eagles exhibit high nest site fidelity and nesting territories are often used year after year. Some territories are known to have been used continually for over half a century.

Bald eagles generally nest near coastlines, rivers, large lakes or streams that support an adequate food supply. They often nest in mature or old-growth trees; snags (dead trees); cliffs; rock promontories; rarely on the ground; and with increasing frequency on human-made structures such as power poles and communication towers. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that can weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water where the eagles usually forage. Shoreline trees or snags located in reservoirs provide the visibility and accessibility needed to locate aquatic prey. Eagle nests are constructed with large sticks, and may be lined with moss, grass, plant stalks, lichens, seaweed, or sod. Nests are usually about 4-6 feet in diameter and 3 feet deep, although larger nests exist.

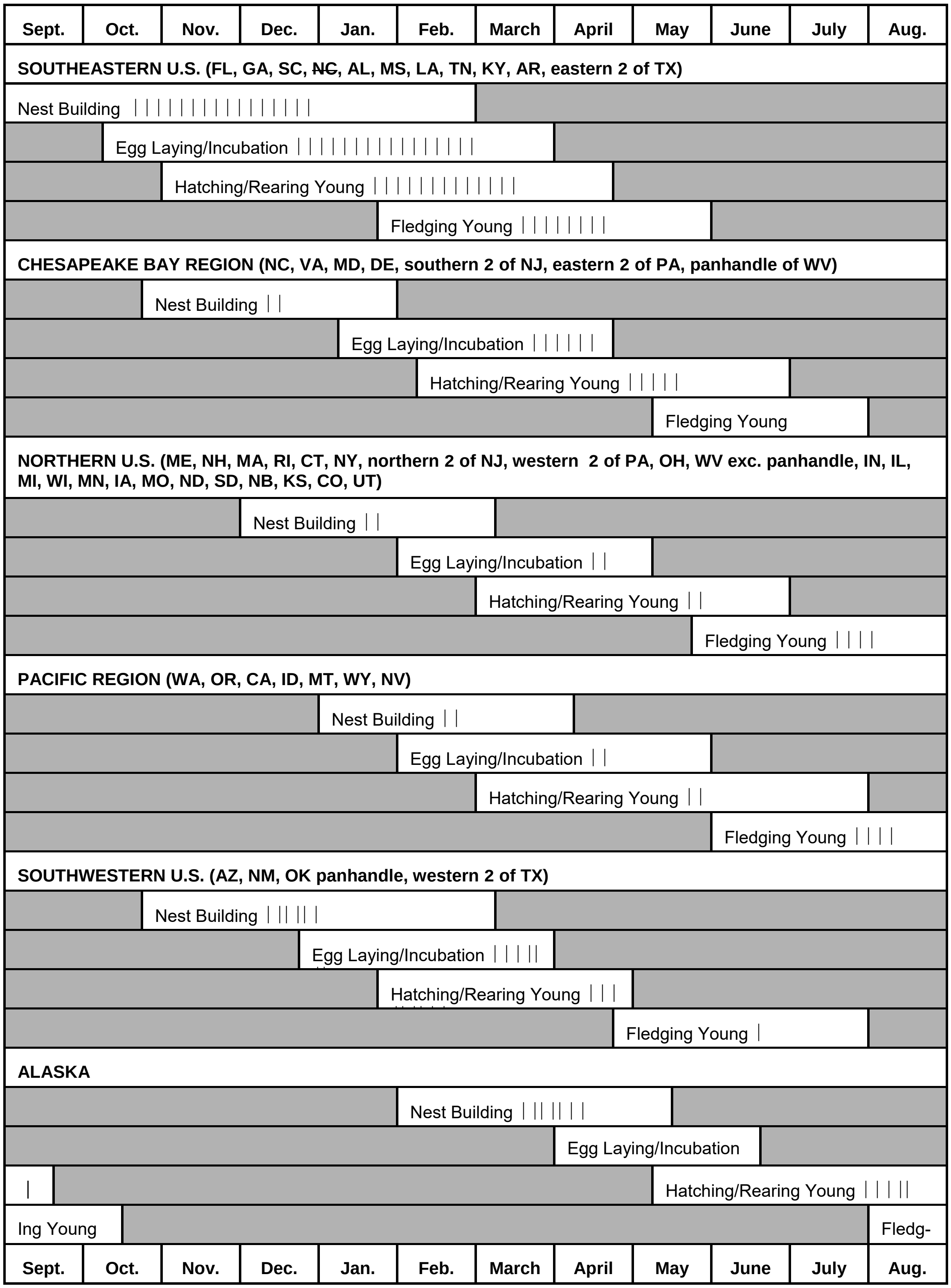
The range of breeding bald eagles in 2000 (shaded areas). This map shows only the larger concentrations of nests; eagles have continued to expand into additional nesting territories in many states. The dotted line represents the bald eagle’s wintering range.

When do bald eagles nest?

Nesting activity begins several months before egg-laying. Egg-laying dates vary throughout the U.S., ranging from October in Florida, to late April or even early May in the northern United States. Incubation typically lasts 33-35 days, but can be as long as 40 days. Eaglets make their first unsteady flights about 10 to 12 weeks after hatching, and fledge (leave their nests) within a few days after that first flight. However, young birds usually remain in the vicinity of the nest for several weeks after fledging because they are almost completely dependent on their parents for food until they disperse from the nesting territory approximately 6 weeks later.

The bald eagle breeding season tends to be longer in the southern U.S., and re-nesting following an unsuccessful first nesting attempt is more common there as well. The following table shows the timing of bald eagle breeding seasons in different regions of the country. The table represents the range of time within which the majority of nesting activities occur in each region and does not apply to any specific nesting pair. Because the timing of nesting activities may vary within a given region, you should contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16) and/or your state wildlife conservation agency for more specific information on nesting chronology in your area.

Chronology of typical reproductive activities of bald eagles in the United States.



How many chicks do bald eagles raise?
The number of eagle eggs laid will vary from 1-3, with 1-2 eggs being the most common. Only one eagle egg is laid per day, although not always on successive days. Hatching of young occurs on different days with the result that chicks in the same nest are sometimes of unequal size. The overall national fledging rate is approximately one chick per nest, annually, which results in a healthy expanding population.

What do bald eagles eat?
Bald eagles are opportunistic feeders. Fish comprise much of their diet, but they also eat waterfowl, shorebirds/colonial waterbirds, small mammals, turtles, and carrion. Because they are visual hunters, eagles typically locate their prey from a conspicuous perch, or soaring flight, then swoop down and strike. Wintering bald eagles often congregate in large numbers along streams to feed on spawning salmon or other fish species, and often gather in large numbers in areas below reservoirs, especially hydropower dams, where fish are abundant. Wintering eagles also take birds from rafts of ducks at reservoirs and rivers, and congregate on melting ice shelves to scavenge dead fish from the current or the soft melting ice. Bald eagles will also feed on carcasses along roads, in landfills, and at feedlots.

During the breeding season, adults carry prey to the nest to feed the young. Adults feed their chicks by tearing off pieces of food and holding them to the beaks of the eaglets. After fledging, immature eagles are slow to develop hunting skills, and must learn to locate reliable food sources and master feeding techniques. Young eagles will congregate together, often feeding upon easily acquired food such as carrion and fish found in abundance at the mouths of streams and shallow bays and at landfills.

The impact of human activity on nesting bald eagles
During the breeding season, bald eagles are sensitive to a variety of human activities. However, not all bald eagle pairs react to human activities in the same way. Some pairs nest successfully just dozens of yards from human activity, while others abandon nest sites in response to activities much farther away. This variability may be related to a number of factors, including visibility, duration, noise levels, extent of the area affected by the activity, prior experiences with humans, and tolerance of the individual nesting pair. The relative sensitivity of bald eagles during various stages of the breeding season is outlined in the following table.

Nesting Bald Eagle Sensitivity to Human Activities

Phase	Activity	Sensitivity to Human Activity	Comments
I	Courtship and Nest Building	Most sensitive period; likely to respond negatively	Most critical time period. Disturbance is manifested in nest abandonment. Bald eagles in newly established territories are more prone to abandon nest sites.
II	Egg laying	Very sensitive period	Human activity of even limited duration may cause nest desertion and abandonment of territory for the breeding season.
III	Incubation and early nestling period (up to 4 weeks)	Very sensitive period	Adults are less likely to abandon the nest near and after hatching. However, flushed adults leave eggs and young unattended; eggs are susceptible to cooling, loss of moisture, overheating, and predation; young are vulnerable to elements.
IV	Nestling period, 4 to 8 weeks	Moderately sensitive period	Likelihood of nest abandonment and vulnerability of the nestlings to elements somewhat decreases. However, nestlings may miss feedings, affecting their survival.
V	Nestlings 8 weeks through fledging	Very sensitive period	Gaining flight capability, nestlings 8 weeks and older may flush from the nest prematurely due to disruption and die.

If agitated by human activities, eagles may inadequately construct or repair their nest, may expend energy defending the nest rather than tending to their young, or may abandon the nest altogether. Activities that cause prolonged absences of adults from their nests can jeopardize eggs or young. Depending on weather conditions, eggs may overheat or cool too much and fail to hatch. Unattended eggs and nestlings are subject to predation. Young nestlings are particularly vulnerable because they rely on their parents to provide warmth or shade, without which they may die as a result of hypothermia or heat stress. If food delivery schedules are interrupted, the young may not develop healthy plumage, which can affect their survival. In addition, adults startled while incubating or brooding young may damage eggs or injure their young as they abruptly leave the nest. Older nestlings no longer require constant attention from the adults, but they may be startled by loud or intrusive human activities and prematurely jump from the nest before they are able to fly or care for themselves. Once fledged, juveniles range up to ¼ mile from the nest site, often to a site with minimal human activity. During this period, until about six weeks after departure from the nest, the juveniles still depend on the adults to feed them.

The impact of human activity on foraging and roosting bald eagles

Disruption, destruction, or obstruction of roosting and foraging areas can also negatively affect bald eagles. Disruptive activities in or near eagle foraging areas can interfere with feeding, reducing chances of survival. Interference with feeding can also result in reduced productivity (number of young successfully fledged). Migrating and wintering bald eagles often congregate at specific sites for purposes of feeding and sheltering. Bald eagles rely on established roost sites because of their proximity to sufficient food sources. Roost sites are usually in mature trees where the eagles are somewhat sheltered from the wind and weather. Human activities near or within communal roost sites may prevent eagles from feeding or taking shelter, especially if there are not other undisturbed and productive feeding and roosting sites available. Activities that permanently alter communal roost sites and important foraging areas can altogether eliminate the elements that are essential for feeding and sheltering eagles.

Where a human activity agitates or bothers roosting or foraging bald eagles to the degree that causes injury or substantially interferes with breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Eagle Act's prohibition against disturbing eagles. The circumstances that might result in such an outcome are difficult to predict without detailed site-specific information. If your activities may disturb roosting or foraging bald eagles, you should contact your local Fish and Wildlife Service Field Office (see page 16) for advice and recommendations for how to avoid such disturbance.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT NEST SITES

In developing these Guidelines, we relied on existing state and regional bald eagle guidelines, scientific literature on bald eagle disturbance, and recommendations of state and Federal biologists who monitor the impacts of human activity on eagles. Despite these resources, uncertainties remain regarding the effects of many activities on eagles and how eagles in different situations may or may not respond to certain human activities. The Service recognizes this uncertainty and views the collection of better biological data on the response of eagles to disturbance as a high priority. To the extent that resources allow, the Service will continue to collect data on responses of bald eagles to human activities conducted according to the recommendations within these Guidelines to ensure that adequate protection from disturbance is being afforded, and to identify circumstances where the Guidelines might be modified. These data will be used to make future adjustments to the Guidelines.

To avoid disturbing nesting bald eagles, we recommend (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season. The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees.

The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there are little or no forested or topographical buffers, such as in many western states, distance alone must serve as the buffer. Consequently, in open areas, the distance between the activity and the nest may need to be larger than the distances recommended under Categories A and B of these guidelines (pg. 12) if no landscape buffers are present. The height of the nest above the ground may also ameliorate effects of human activities; eagles at higher nests may be less prone to disturbance.

In addition to the physical features of the landscape and nest site, the appropriate size for the distance buffer may vary according to the historical tolerances of eagles to human activities in particular localities, and may also depend on the location of the nest in relation to feeding and roosting areas used by the eagles. Increased competition for nest sites may lead bald eagles to nest closer to human activity (and other eagles).

Seasonal restrictions can prevent the potential impacts of many shorter-term, obtrusive activities that do not entail landscape alterations (e.g. fireworks, outdoor concerts). In proximity to the nest, these kinds of activities should be conducted only outside the breeding season. For activities that entail both short-term, obtrusive characteristics and more permanent impacts (e.g., building construction), we recommend a combination of both approaches: retaining a landscape buffer *and* observing seasonal restrictions.

For assistance in determining the appropriate size and configuration of buffers or the timing of activities in the vicinity of a bald eagle nest, we encourage you to contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16).

Existing Uses

Eagles are unlikely to be disturbed by routine use of roads, homes, and other facilities where such use pre-dates the eagles' successful nesting activity in a given area. Therefore, in most cases *ongoing* existing uses may proceed with the same intensity with little risk of disturbing bald eagles. However, some *intermittent, occasional, or irregular* uses that pre-date eagle nesting in an area may disturb bald eagles. For example: a pair of eagles may begin nesting in an area and subsequently be disturbed by activities associated with an annual outdoor flea market, even though the flea market has been held annually at the same location. In such situations, human activity should be adjusted or relocated to minimize potential impacts on the nesting pair.

ACTIVITY-SPECIFIC GUIDELINES

The following section provides the Service=s management recommendations for avoiding bald eagle disturbance as a result of new or intermittent activities proposed in the vicinity of bald eagle nests. Activities are separated into 8 categories (A – H) based on the nature and magnitude of impacts to bald eagles that usually result from the type of activity. Activities with similar or comparable impacts are grouped together.

In most cases, impacts will vary based on the visibility of the activity from the eagle nest and the degree to which similar activities are already occurring in proximity to the nest site. Visibility is a factor because, in general, eagles are more prone to disturbance when an activity occurs in full view. For this reason, we recommend that people locate activities farther from the nest structure in areas with open vistas, in contrast to areas where the view is shielded by rolling topography, trees, or other screening factors. The recommendations also take into account the existence of similar activities in the area because the continued presence of nesting bald eagles in the vicinity of the existing activities indicates that the eagles in that area can tolerate a greater degree of human activity than we can generally expect from eagles in areas that experience fewer human impacts. To illustrate how these factors affect the likelihood of disturbing eagles, we have incorporated the recommendations for some activities into a table (categories A and B).

First, determine which category your activity falls into (between categories A – H). If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity represented.

If your activity is under A or B, our recommendations are in table form. The vertical axis shows the degree of visibility of the activity from the nest. The horizontal axis (header row) represents the degree to which similar activities are ongoing in the vicinity of the nest. Locate the row that best describes how visible your activity will be from the eagle nest. Then, choose the column that best describes the degree to which similar activities are ongoing in the vicinity of the eagle nest. The box where the column and row come together contains our management recommendations for how far you should locate your activity from the nest to avoid disturbing the eagles. The numerical distances shown in the tables are the closest the activity should be conducted relative to the nest. In some cases we have included additional recommendations (other than recommended *distance* from the nest) you should follow to help ensure that your activity will not disturb the eagles.

Alternate nests

For activities that entail permanent landscape alterations that may result in bald eagle disturbance, these recommendations apply to both active and alternate bald eagle nests. Disturbance becomes an issue with regard to alternate nests if eagles return for breeding purposes and react to land use changes that occurred while the nest was inactive. The likelihood that an alternate nest will again become active decreases the longer it goes unused. If you plan activities in the vicinity of an alternate bald eagle nest and have information to show that the nest has not been active during the preceding 5 breeding seasons, the recommendations provided in these guidelines for avoiding disturbance around the nest site may no longer be warranted. The nest itself remains protected by other provisions of the Eagle Act, however, and may not be destroyed.

If special circumstances exist that make it unlikely an inactive nest will be reused before 5 years of disuse have passed, and you believe that the probability of reuse is low enough to warrant disregarding the recommendations for avoiding disturbance, you should be prepared to provide all the reasons for your conclusion, including information regarding past use of the nest site. Without sufficient documentation, you should continue to follow these guidelines when conducting activities around the nest site. If we are able to determine that it is unlikely the nest will be reused, we may advise you that the recommendations provided in these guidelines for avoiding disturbance are no longer necessary around that nest site.

This guidance is intended to minimize disturbance, as defined by Federal regulation. In addition to Federal laws, most states and some tribes and smaller jurisdictions have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines.

Temporary Impacts

For activities that have temporary impacts, such as the use of loud machinery, fireworks displays, or summer boating activities, we recommend seasonal restrictions. These types of activities can generally be carried out outside of the breeding season without causing disturbance. The recommended restrictions for these types of activities can be lifted for alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched (depending on the distance between the alternate nest and the active nest).

In general, activities should be kept as far away from nest trees as possible; loud and disruptive activities should be conducted when eagles are not nesting; and activity between the nest and the nearest foraging area should be minimized. If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity addressed, or contact your local U.S. Fish and Wildlife Service Field Office for additional guidance.

If you believe that special circumstances apply to your situation that increase or diminish the likelihood of bald eagle disturbance, or if it is not possible to adhere to the guidelines, you should contact your local Service Field Office for further guidance.

Category A:
Building construction, 1 or 2 story, with project footprint of ½ acre or less.
Construction of roads, trails, canals, power lines, and other linear utilities.
Agriculture and aquaculture – new or expanded operations.
Alteration of shorelines or wetlands.
Installation of docks or moorings.
Water impoundment.

Category B:
Building construction, 3 or more stories.
Building construction, 1 or 2 story, with project footprint of more than ½ acre.
Installation or expansion of marinas with a capacity of 6 or more boats.
Mining and associated activities.
Oil and natural gas drilling and refining and associated activities.

	If there is no similar activity within 1 mile of the nest	***If there is similar activity closer than 1 mile from the nest***
If the activity will be visible from the nest	660 feet. Landscape buffers are recommended.	660 feet, or as close as existing tolerated activity of similar scope. Landscape buffers are recommended.
If the activity will not be visible from the nest	Category A: 330 feet. Clearing, external construction, and landscaping between 330 feet and 660 feet should be done outside breeding season. Category B: 660 feet.	330 feet, or as close as existing tolerated activity of similar scope. Clearing, external construction and landscaping within 660 feet should be done outside breeding season.

The numerical distances shown in the table are the closest the activity should be conducted relative to the nest.

Category C. Timber Operations and Forestry Practices

- Avoid clear cutting or removal of overstory trees within 330 feet of the nest at any time.

- Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the breeding season within 660 feet of the nest. The distance may be decreased to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched.

- Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to the nest tree, should be undertaken outside the breeding season. Precautions such as raking leaves and woody debris from around the nest tree should be taken to prevent crown fire or fire climbing the nest tree. If it is determined that a burn during the breeding season would be beneficial, then, to ensure that no take or disturbance will occur, these activities should be conducted only when neither adult eagles nor young are present at the nest tree (i.e., at the beginning of, or end of, the breeding season, either before the particular nest is active or after the young have fledged from that nest). Appropriate Federal and state biologists should be consulted before any prescribed burning is conducted during the breeding season.

- Avoid construction of log transfer facilities and in-water log storage areas within 330 feet of the nest.

Category D. Off-road vehicle use (including snowmobiles). No buffer is necessary around nest sites outside the breeding season. During the breeding season, do not operate off-road vehicles within 330 feet of the nest. In open areas, where there is increased visibility and exposure to noise, this distance should be extended to 660 feet.

Category E. Motorized Watercraft use (including jet skis/personal watercraft). No buffer is necessary around nest sites outside the breeding season. During the breeding season, within 330 feet of the nest, (1) do not operate jet skis (personal watercraft), and (2) avoid concentrations of noisy vessels (e.g., commercial fishing boats and tour boats), except where eagles have demonstrated tolerance for such activity. Other motorized boat traffic passing within 330 feet of the nest should attempt to minimize trips and avoid stopping in the area where feasible, particularly where eagles are unaccustomed to boat traffic. Buffers for airboats should be larger than 330 feet due to the increased noise they generate, combined with their speed, maneuverability, and visibility.

Category F. Non-motorized recreation and human entry (e.g., hiking, camping, fishing, hunting, birdwatching, kayaking, canoeing). No buffer is necessary around nest sites outside the breeding season. If the activity will be visible or highly audible from the nest, maintain a 330-foot buffer during the breeding season, particularly where eagles are unaccustomed to such activity.

Category G. Helicopters and fixed-wing aircraft.
Except for authorized biologists trained in survey techniques, avoid operating aircraft within 1,000 feet of the nest during the breeding season, except where eagles have demonstrated tolerance for such activity.

Category H. Blasting and other loud, intermittent noises.
Avoid blasting and other activities that produce extremely loud noises within 1/2 mile of active nests, unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area. This recommendation applies to the use of fireworks classified by the Federal Department of Transportation as Class B explosives, which includes the larger fireworks that are intended for licensed public display.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT FORAGING AREAS AND COMMUNAL ROOST SITES

1. Minimize potentially disruptive activities and development in the eagles' direct flight path between their nest and roost sites and important foraging areas.

2. Locate long-term and permanent water-dependent facilities, such as boat ramps and marinas, away from important eagle foraging areas.

3. Avoid recreational and commercial boating and fishing near critical eagle foraging areas during peak feeding times (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

4. Do not use explosives within ½ mile (or within 1 mile in open areas) of communal roosts when eagles are congregating, without prior coordination with the U.S. Fish and Wildlife Service and your state wildlife agency.

5. Locate aircraft corridors no closer than 1,000 feet vertical or horizontal distance from communal roost sites.

ADDITIONAL RECOMMENDATIONS TO BENEFIT BALD EAGLES

The following are additional management practices that landowners and planners can exercise for added benefit to bald eagles.

1. Protect and preserve potential roost and nest sites by retaining mature trees and old growth stands, particularly within ½ mile from water.

2. Where nests are blown from trees during storms or are otherwise destroyed by the elements, continue to protect the site in the absence of the nest for up to three (3) complete breeding seasons. Many eagles will rebuild the nest and reoccupy the site.

3. To avoid collisions, site wind turbines, communication towers, and high voltage transmission power lines away from nests, foraging areas, and communal roost sites.

4. Employ industry-accepted best management practices to prevent birds from colliding with or being electrocuted by utility lines, towers, and poles. If possible, bury utility lines in important eagle areas.

5. Where bald eagles are likely to nest in human-made structures (e.g., cell phone towers) and such use could impede operation or maintenance of the structures or jeopardize the safety of the eagles, equip the structures with either (1) devices engineered to discourage bald eagles from building nests, or (2) nesting platforms that will safely accommodate bald eagle nests without interfering with structure performance.

6. Immediately cover carcasses of euthanized animals at landfills to protect eagles from being poisoned.

7. Do not intentionally feed bald eagles. Artificially feeding bald eagles can disrupt their essential behavioral patterns and put them at increased risk from power lines, collision with windows and cars, and other mortality factors.

8. Use pesticides, herbicides, fertilizers, and other chemicals only in accordance with Federal and state laws.

9. Monitor and minimize dispersal of contaminants associated with hazardous waste sites (legal or illegal), permitted releases, and runoff from agricultural areas, especially within watersheds where eagles have shown poor reproduction or where bioaccumulating contaminants have been documented. These factors present a risk of contamination to eagles and their food sources.

CONTACTS

The following U.S. Fish and Wildlife Service Field Offices provide technical assistance on bald eagle management:

Alabama	Daphne	(251) 441-5181
Alaska	Anchorage	(907) 271-2888
	Fairbanks	(907) 456-0203
	Juneau	(907) 780-1160
Arizona	Phoenix	(602) 242-0210
Arkansas	Conway	(501) 513-4470
California	Arcata	(707) 822-7201
	Barstow	(760) 255-8852
	Carlsbad	(760) 431-9440
	Red Bluff	(530) 527-3043
	Sacramento	(916) 414-6000
	Stockton	(209) 946-6400
	Ventura	(805) 644-1766
	Yreka	(530) 842-5763
Colorado	Lakewood	(303) 275-2370
	Grand Junction	(970) 243-2778
Connecticut	(See New Hampshire)	
Delaware	(See Maryland)	
Florida	Panama City	(850) 769-0552
	Vero Beach	(772) 562-3909
	Jacksonville	(904) 232-2580
Georgia	Athens	(706) 613-9493
	Brunswick	(912) 265-9336
	Columbus	(706) 544-6428
Idaho	Boise	(208) 378-5243
	Chubbuck	(208) 237-6975
Illinois/Iowa	Rock Island	(309) 757-5800
Indiana	Bloomington	(812) 334-4261
Kansas	Manhattan	(785) 539-3474
Kentucky	Frankfort	(502) 695-0468
Louisiana	Lafayette	(337) 291-3100
Maine	Old Town	(207) 827-5938
Maryland	Annapolis	(410) 573-4573
Massachusetts	(See New Hampshire)	
Michigan	East Lansing	(517) 351-2555
Minnesota	Bloomington	(612) 725-3548
Mississippi	Jackson	(601) 965-4900
Missouri	Columbia	(573) 234-2132
Montana	Helena	(405) 449-5225
Nebraska	Grand Island	(308) 382-6468
Nevada	Las Vegas	(702) 515-5230
	Reno	(775) 861-6300
New Hampshire	Concord	(603) 223-2541
New Jersey	Pleasantville	(609) 646-9310
New Mexico	Albuquerque	(505) 346-2525
New York	Cortland	(607) 753-9334
	Long Island	(631) 776-1401
North Carolina	Raleigh	(919) 856-4520
	Asheville	(828) 258-3939
North Dakota	Bismarck	(701) 250-4481
Ohio	Reynoldsburg	(614) 469-6923
Oklahoma	Tulsa	(918) 581-7458
Oregon	Bend	(541) 383-7146
	Klamath Falls	(541) 885-8481
	La Grande	(541) 962-8584
	Newport	(541) 867-4558
	Portland	(503) 231-6179
	Roseburg	(541) 957-3474
Pennsylvania	State College	(814) 234-4090
Rhode Island	(See New Hampshire)	
South Carolina	Charleston	(843) 727-4707
South Dakota	Pierre	(605) 224-8693
Tennessee	Cookeville	(931) 528-6481
Texas	Clear Lake	(281) 286-8282
Utah	West Valley City	(801) 975-3330
Vermont	(See New Hampshire)	
Virginia	Gloucester	(804) 693-6694
Washington	Lacey	(306) 753-9440
	Spokane	(509) 891-6839
	Wenatchee	(509) 665-3508
West Virginia	Elkins	(304) 636-6586
Wisconsin	New Franken	(920) 866-1725
Wyoming	Cheyenne	(307) 772-2374
	Cody	(307) 578-5939

National Office
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
4401 North Fairfax Drive, MBSP-4107
Arlington, VA 22203-1610
(703) 358-1714
http://www.fws.gov/migratorybirds

State Agencies

To contact a state wildlife agency, visit the Association of Fish & Wildlife Agencies' website at http://www.fishwildlife.org/where_us.html

GLOSSARY

The definitions below apply to these National Bald Eagle Management Guidelines:

Communal roost sites – Areas where bald eagles gather and perch overnight – and sometimes during the day in the event of inclement weather. Communal roost sites are usually in large trees (live or dead) that are relatively sheltered from wind and are generally in close proximity to foraging areas. These roosts may also serve a social purpose for pair bond formation and communication among eagles. Many roost sites are used year after year.

Disturb – To agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

Fledge – To leave the nest and begin flying. For bald eagles, this normally occurs at 10-12 weeks of age.

Fledgling – A juvenile bald eagle that has taken the first flight from the nest but is not yet independent.

Foraging area – An area where eagles feed, typically near open water such as rivers, lakes, reservoirs, and bays where fish and waterfowl are abundant, or in areas with little or no water (i.e., rangelands, barren land, tundra, suburban areas, etc.) where other prey species (e.g., rabbit, rodents) or carrion (such as at landfills) are abundant.

Landscape buffer – A natural or human-made landscape feature that screens eagles from human activity (e.g., strip of trees, hill, cliff, berm, sound wall).

Nest – A structure built, maintained, or used by bald eagles for the purpose of reproduction. An **active** nest is a nest that is attended (built, maintained or used) by a pair of bald eagles during a given breeding season, whether or not eggs are laid. An **alternate** nest is a nest that is not used for breeding by eagles during a given breeding season.

Nest abandonment – Nest abandonment occurs when adult eagles desert or stop attending a nest and do not subsequently return and successfully raise young in that nest for the duration of a breeding season. Nest abandonment can be caused by altering habitat near a nest, even if the alteration occurs prior to the breeding season. Whether the eagles migrate during the non-breeding season, or remain in the area throughout the non-breeding season, nest abandonment can occur at any point between the time the eagles return to the nesting site for the breeding season and the time when all progeny from the breeding season have dispersed.

Project footprint – The area of land (and water) that will be permanently altered for a development project, including access roads.

Similar scope – In the vicinity of a bald eagle nest, an existing activity is of similar scope to a new activity where the types of impacts to bald eagles are similar in nature, and the impacts of the existing activity are of the same or greater magnitude than the impacts of the potential new activity. Examples: (1) An existing single-story home 200 feet from a nest is similar in scope to an additional single-story home 200 feet from the nest; (2) An existing multi-story, multi-family dwelling 150 feet from a nest has impacts of a greater magnitude than a potential new single-family home 200 feet from the nest; (3) One existing single-family home 200 feet from the nest has impacts of a lesser magnitude than three single-family homes 200 feet from the nest; (4) an existing single-family home 200 feet from a communal roost has impacts of a lesser magnitude than a single-family home 300 feet from the roost but 40 feet from the eagles' foraging area. The existing activities in examples (1) and (2) are of similar scope, while the existing activities in example (3) and (4) are not.

Vegetative buffer – An area surrounding a bald eagle nest that is wholly or largely covered by forest, vegetation, or other natural ecological characteristics, and separates the nest from human activities.

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APPENDIX E

COMMUNICATION TOWER AND POWERLINE CONSTRUCTION GUIDELINES

Communications Tower Siting, Construction, Operation, and Decommissioning Recommendations

U.S. Fish and Wildlife Service Interim Guidelines

1. Any company/applicant/licensee proposing to construct a new communications tower should be strongly encouraged to collocate the communications equipment on an existing communication tower or other structure (*e.g.,* billboard, water tower, or building mount). Depending on tower load factors, from 6 to 10 providers may collocate on an existing tower.

2. If collocation is not feasible and a new tower or towers are to be constructed, communications service providers should be strongly encouraged to construct towers no more than 199 feet above ground level (AGL), using construction techniques which do not require guy wires (*e.g.,* use a lattice structure, monopole, etc.). Such towers should be unlighted if Federal Aviation Administration regulations permit.

3. If constructing multiple towers, providers should consider the cumulative impacts of all of those towers to migratory birds and threatened and endangered species as well as the impacts of each individual tower.

4. If at all possible, new towers should be sited within existing "antenna farms" (clusters of towers). Towers should not be sited in or near wetlands, other known bird concentration areas (*e.g.,* state or Federal refuges, staging areas, rookeries), in known migratory or daily movement flyways, or in habitat of threatened or endangered species. Towers should not be sited in areas with a high incidence of fog, mist, and low ceilings.

5. If taller (>199 feet AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used.

6. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract night-

migrating birds at a much higher rate than white strobe lights. Red strobe lights have not yet been studied.

7. Tower designs using guy wires for support which are proposed to be located in known raptor or waterbird concentration areas or daily movement routes, or in major diurnal migratory bird movement routes or stopover sites, should have daytime visual markers on the wires to prevent collisions by these diurnally moving species.

   For guidance on markers, see *Avian Power Line Interaction Committee (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington, D.C., 78 pp*,

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   Avian Power Line Interaction Committee (APLIC). 2006. Mitigating Bird Collisions with Power Lines: The State of the Art in 2006. Edison Electric Institute, Washington, D.C., 207 pp - -available online as PDF

   Copies can be obtained via the Internet at http://www.aplic.org/, or by calling 1-800/334-5453.

8. Towers and appendant facilities should be sited, designed and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint". However, a larger tower footprint is preferable to the use of guy wires in construction. Road access and fencing should be minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above ground obstacles to birds in flight.

9. If significant numbers of breeding, feeding, or roosting birds are known to habitually use the proposed tower construction area, relocation to an alternate site should be recommended. If this is not an option, seasonal restrictions on construction may be advisable in order to avoid disturbance during periods of high bird activity.

10. In order to reduce the number of towers needed in the future, providers should be encouraged to design new towers structurally and electrically to accommodate the applicant/licensee's antennas and comparable antennas for at least two additional users (minimum of three users for each tower structure), unless this design would require the addition of lights or guy wires to an otherwise unlighted and/or unguyed tower.

11. Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site.

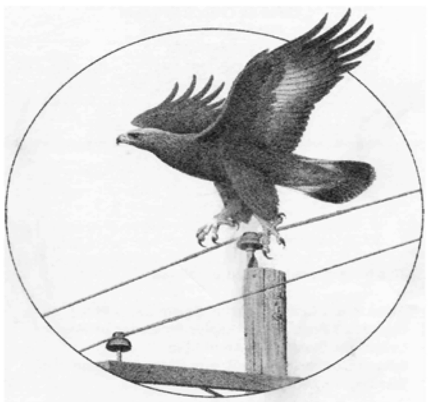
12. If a tower is constructed or proposed for construction, Service personnel or researchers from the Communication Tower Working Group should be allowed access to the site to evaluate bird use, conduct dead-bird searches, to place net catchments below the towers but above the ground, and to place radar, Global Positioning System, infrared, thermal imagery, and acoustical monitoring equipment as necessary to assess and verify bird movements and to gain information on the impacts of various tower sizes, configurations, and lighting systems.

13. Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use.

If you have questions about these Guidelines or need further assistance, please contact the Ecological Services office nearest your project area.

Last updated: October 24, 2012

AVIAN PROTECTION PLAN (APP)
GUIDELINES



A Joint Document Prepared By

The Edison Electric Institute's Avian Power Line Interaction Committee (APLIC)

and

U.S. Fish and Wildlife Service (USFWS)

April 2005

ACKNOWLEDGEMENT

APLIC and the U.S. Fish and Wildlife Service (Service) have a long history of cooperation and collaboration on avian issues. Like the Service, current APLIC member utilities want to do their part to minimize adverse impacts to protected avian species on power lines. The public expects utilities to deliver cost-effective reliable energy and the Service to protect and enhance trust resources. Working in a partnership to benefit both the birds and the electric utility industry, the voluntary Avian Protection Plan (APP) Guidelines were developed in a joint, collaborative way.

It is the hope of both APLIC and the Service that individual utilities will utilize the voluntary principles in this document to develop an APP specific to their needs, which improves reliability and avian conservation. APPs offer the industry an additional option, one that is voluntary and without the need for formal Service concurrence, to address avian electrocutions and collisions. Utilities are also encouraged to work in partnership with Federal and State resource agencies when developing and implementing their voluntary APPs.

APLIC and the Service would like to acknowledge the efforts of those individuals responsible for the development of these voluntary guidelines. These guidelines demonstrate that through ongoing collaborative efforts the Service and industry can work together to meet energy needs while acting as responsible stewards to the environment.

April 14, 2005

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The APP Guidelines presented in this document are intended to serve as a "tool box" from which a utility can select and tailor components applicable to its specific needs. These guidelines are intended to be used in conjunction with APLIC's *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* and *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*, or the most current editions of these documents, which contain more detail on construction design standards and line siting recommendations.

These "guidelines" are being distributed electronically. While the introductory pages of the document are printed, the remainder of this "tool box" is electronic. This is a dynamic document and will be periodically updated as new information and resources become available. Additional copies of the APP Guidelines and current information on related issues can be downloaded from the Avian Power Line Interaction Committee (APLIC) (http://aplic.org) and Edison Electric Institute (EEI) (http://eei.org) websites. In addition, the *Suggested Practices for Raptor Protection on Power Lines* and *Mitigating Bird Collisions with Power Lines* manuals can be obtained from APLIC or EEI.

Editor's note: Although this draft is being distributed in paper format, the final version will be distributed electronically as described above.

TABLE OF CONTENTS

I. INTRODUCTION

Since the formation of the Avian Power Line Interaction Committee (APLIC) in 1989, the electric utility industry and the U.S. Fish and Wildlife Service (USFWS) have worked together to reduce avian electrocution and collision mortality. This has resulted in the cooperative development of guidelines for Avian Protection Plans (APP) by APLIC and USFWS, representing another milestone in avian conservation. The principles presented in these voluntary guidelines are intended to allow utilities to tailor an APP that will best fit their needs while furthering the conservation of avian species and improving reliability and customer service. A utility that implements the principles contained in these APP guidelines will greatly reduce avian risk as well its own risk of enforcement under the Migratory Bird Treaty Act (MBTA). Development and implementation of an APP makes good business sense because animal- and bird-caused outages are costly. A utility that creates an APP following these guidelines and that addresses their specific avian issues can benefit through regulatory compliance, reliability improvements, cost savings and positive recognition from regulators and customers.

What is an Avian Protection Plan?

An Avian Protection Plan is a utility-specific document that delineates a program designed to reduce the operational and avian risks that result from avian interactions with electric utility facilities. Although each utility's APP will be different, the overall goal of any APP should be to reduce avian mortality. This document provides guiding principles and examples to aid utilities in their development of an APP. Although not all of these elements need to be included in every APP because of the specific circumstances of a utility or geographical area, they represent an overview of elements that should be considered for inclusion in an APP and that individual utilities may find helpful in crafting their own, individually-tailored APPs.

Principles of an Avian Protection Plan

1. *Corporate Policy*

    An APP typically includes a statement of company policy confirming the company's commitment to work cooperatively towards the protection of migratory birds. This may include a commitment by the company to balance its goal of providing reliable electrical service in a cost-effective manner with the regulatory requirements protecting avian species, as well as the need to obtain and comply with all necessary permits, monitor incidents of avian mortality, and make reasonable efforts to construct and alter infrastructure to reduce the incidence of avian mortality.

2. *Training*

    Training is an important element of an APP. All appropriate utility personnel, including managers, supervisors, line crews, engineering, dispatch, and design personnel, should be properly trained in avian issues. This training should encompass the reasons, need, and method by which employees should report an avian mortality, follow nest management protocols, dispose of carcasses, and comply with applicable regulations, including the consequences of non-compliance. Supplemental training also may be appropriate where there are material changes in regulations, permit conditions, or internal policies. APLIC-sponsored "short courses" on avian electrocution, collision, and nest issues are conducted annually throughout the U.S. In addition, a two-hour overview presentation of avian issues that can be used for internal company training is available from APLIC (see http://aplic.org).

3. *Permit Compliance*

    An APP can identify the process under which a company obtains and complies with all necessary permits related to avian issues. Particular attention should be given to specific activities that can require take permits including, but not limited to, nest relocation, temporary possession, depredation, salvage/disposal, and scientific collection.

4. *Construction Design Standards*

Avian interactions with facilities can cause outages or system reliability issues. To improve system reliability, avian interactions should be considered in the design and installation of new facilities, as well as the operation and maintenance of existing facilities. For those reasons, inclusion of accepted construction standards for both new and retrofit techniques also should be included in an APP. Companies can either rely upon existing construction configurations recommended by APLIC (see *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* and *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*, or the most current editions of these documents) or may choose to instead develop their own internal construction standards that meet or exceed these guidelines. These standards should be used in areas where new construction should be avian-safe, as well as where existing infrastructure should be retrofitted to provide avian safety.

5. *Nest Management*

An APP may include procedures for nest management on utility structures. These procedures should be explained to company employees during training to ensure uniform treatment of avian nest issues among personnel.

6. *Avian Reporting System*

Although reporting of avian mortalities may be required as a condition of Federal or State permits, a utility may also choose to voluntarily monitor relevant avian interactions, including mortalities, through the development of an internal reporting system. An APP should consider providing for the development of such a reporting system, which can help a company pinpoint areas of concern by tracking both the specific locations where mortalities may be occurring, as well as the extent of such mortalities. Data collected by company personnel can be limited to avian mortalities or injuries, or could be expanded to include historical tracking of avian nest problems, particularly problematic poles or line configurations, as well as remedial actions taken. All data should be regularly entered into a searchable database compatible for use in additional analysis (see Risk Assessment Methodology below). Bird Mortality Tracking System software developed by APLIC is available for free upon request at http://aplic.org.

7. *Risk Assessment Methodology*

   A utility can have the greatest impact on reducing avian mortality by focusing its efforts in a cost-effective manner on the areas that pose the greatest risk to migratory birds. Therefore, as a general matter, an APP should include a method for evaluating the risks posed to migratory birds in a manner that identifies areas and issues of particular concern. A risk assessment study will often begin with an assessment of available data addressing areas of high avian use, avian mortality, nesting problems, established flyways, adjacent wetlands, prey populations, perch availability, effectiveness of existing procedures, remedial actions and other factors that can increase avian interactions with utility facilities. The avian reporting system discussed in the previous section is an integral component of this risk assessment, as well as the use of avian experts, birders, and biologists who can provide additional information on avian distribution. An APP also may provide for the development of models that will enable a company to utilize biological and electrical design information to prioritize poles most in need of modifications, as well as research on the varied causes of avian mortality and the benefits of utility structures to avian species.

8. *Mortality Reduction Measures*

   After completing a risk assessment, a company can focus its efforts on areas of concern, ensure that the activities taken by the utility are not out of proportion to the risks encountered by migratory birds, and then determine whether an avian mortality reduction plan needs to be implemented in certain areas. An APP could implement this approach by developing such a risk reduction plan, utilizing risk assessment results to direct where system monitoring should occur, where retrofit efforts should be focused, and where new construction warrants special attention to raptor and other bird issues. If a utility finds that implementation of such avian protection measures is appropriate, it also may choose to develop a schedule for implementation.

9. *Avian Enhancement Options*

In addition to taking steps to reduce mortality risk to avian species, an APP also may include opportunities for a utility to enhance avian populations or habitat, including developing nest platforms, managing habitats to benefit migratory birds, or working cooperatively with agencies or organizations in such efforts. Where feasible, such proactive development of new ideas and methods to protect migratory birds should be encouraged and explored.

10. *Quality Control*

An APP also may include a mechanism to review existing practices, ensuring quality control. For instance, a utility may conduct an independent assessment of its avian reporting system to ensure its effectiveness, or invest in research on the effectiveness of different techniques and technologies used to prevent collisions, electrocutions and problem nests.

11. *Public Awareness*

An APP generally should include a method to educate the public about the avian electrocution issue, the company's avian protection program, as well as its successes in avian protection.

12. *Key Resources*

An APP should identify key resources to address avian protection issues including, for example, a list of experts who may be called upon to aid in resolving avian issues. These could include consultants, State and Federal resource agencies, universities, or conservation groups. Engineers may find that internal personnel such as environmental specialists can aid in developing creative solutions to resolve avian interaction problems, and external organizations like APLIC can also serve as helpful resources by providing guidance, workshops, materials, and contacts. An understanding of raptor and other bird behavior can influence how and when avian protection should be utilized, and an APP that connects avian experts with utility decision-makers may reduce the risk of avian incidents and improve system reliability.

II. BACKGROUND

Historical Perspective

Utility poles can benefit raptors by providing perching and/or nesting structures in areas where few natural perches or nest sites exist. However, utility structures can also pose a threat to raptors and other birds through electrocutions or collisions. Although records of electrocutions and collisions date back as early as the late 19th century, avian deaths associated with power lines were not a widespread concern until the 1970's when surveys in the western United States found hundreds of eagles shot, poisoned, and electrocuted in rural areas. Throughout the 1970's, agencies and organizations such as the Rural Electrification Association (now the Rural Utilities Service), USFWS , Edison Electric Institute (EEI), and the National Audubon Society worked together to track raptor electrocutions, identify high risk configurations, and develop methods to reduce electrocutions. In 1989, biologists from the utility industry, USFWS, and the National Audubon Society formed APLIC, initially to address collision issues of sandhill and whooping cranes. The scope of APLIC's mission later expanded to include electrocution and nest issues.

APLIC now serves as a clearinghouse for information and communication on avian/power line issues. Its membership includes electric utilities, EEI, Electric Power Research Institute (EPRI), the National Rural Electric Cooperative Association (NRECA), Rural Utilities Service (RUS) and USFWS. APLIC has produced manuals for addressing electrocutions (*Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996*) as well as collisions (*Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*). In addition, APLIC produces videos addressing collisions and electrocutions; offers a short course overview of collision, electrocution, and nest issues; and funds bird/power line-related research. The APP guidelines provided in this document represent a multidisciplinary culmination of several decades of research, field testing, monitoring and assessment to minimize avian mortality associated with utility structures. APLIC encourages the development of APPs as they benefit utilities and wildlife resources through reduced long-term costs, improved reliability, avian protection, legal compliance, and positive relations between regulatory agencies and customers.

How Electrocution Occurs

Birds are electrocuted by power lines because of two seemingly unrelated, yet interactive factors:

1. Environmental factors such as topography, vegetation, available prey and other, behavioral or biological factors influence avian use of power poles.
2. Inadequate seperation between energized conductors or energized conductors and grounded hardware can provide two points of contact.

Electrocution can occur when a bird completes an electric circuit by simultaneously touching two energized parts or an energized part and a grounded part of the electrical equipment. Most electrocutions occur on medium-voltage distribution lines (4 to 34.5 kilovolts [kV]), in which the spacing between conductors may be small enough to be bridged by birds. Poles with energized hardware, such as transformers, can be especially hazardous, even to small birds, as they contain numerous, closely-spaced energized parts.

"Avian-safe" structures are those that provide adequate clearances to accommodate a large bird between energized and/or grounded parts. Consequently, 60 inches of horizontal separation, which can accommodate the wrist-to-wrist distance of an eagle (which is approximately 54 inches), is used as the standard for raptor protection (Figure 1). Likewise, vertical separation of at least 48 inches can accommodate the height of an eagle from its feet to the top of its head (which is approximately 31 inches; Figure 2). In particular areas (*i.e.* areas with concentrations of wading birds), vertical separation may need to be increased to 60 inches. Because dry feathers act as insulation, contact must be made between fleshy parts, such as the wrists, feet, or other skin, for electrocution to occur. In spite of the best efforts to minimize avian electrocutions, some degree of mortality may always occur due to influences that cannot be controlled, *e.g.* weather.

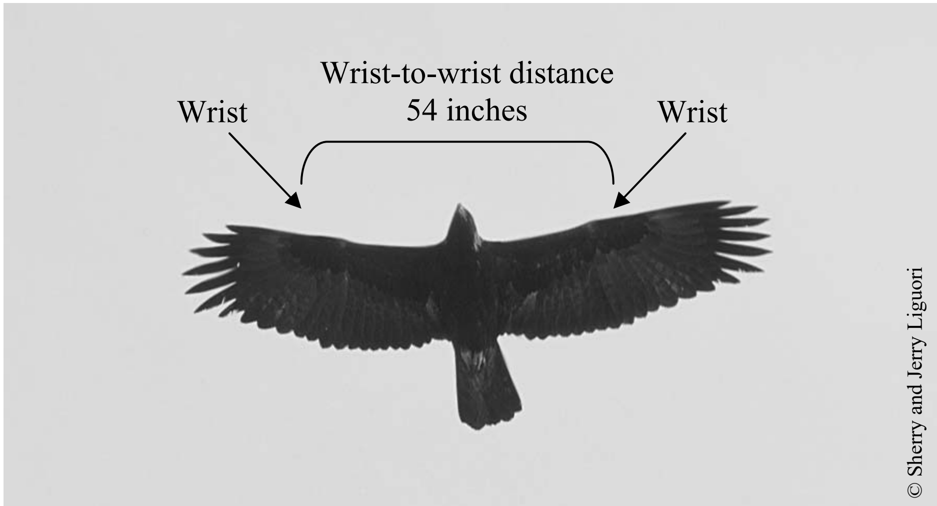

Figure 1. Wrist-to-wrist distance of an eagle.

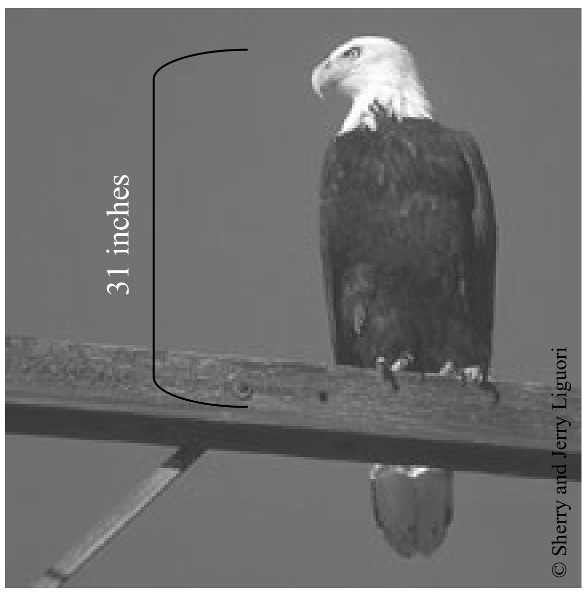

Figure 2. Head to foot distance of an eagle.

Raptors are opportunistic and may use power poles for a number of purposes, such as nest sites, high points from which to defend territories, and perches from which to hunt. “Still hunting” from a perch is energy efficient for a bird, provided that good prey habitat is within view. Some structures are preferred by birds because they provide considerable elevation above the surrounding terrain, thereby offering a wide field of view. Identification and modification of these “preferred” structures may greatly reduce or minimize the electrocution risk on an entire line. However, in areas where lines run through homogeneous terrain, there is no apparent advantage of some poles over others. Favored perches can be identified by examining crossarms and the ground beneath them for whitewash (feces accumulations), pellets, or prey remains. Since birds such as hawks and owls cannot digest the fur, feathers, and bones of their prey, they regurgitate these parts in the form of a “pellet” or “casting.”

What Species are at Risk

Electrocution has been documented as the cause of death in many raptor species in the United States, although large, open-country birds, such as eagles and buteos, are typically at greatest risk. In open habitats where few natural perches exist, such as deserts, grasslands, agricultural fields, and pastures, raptors are attracted to power poles, which provide roosting and nesting sites as well as hunting perches. The large wingspans of raptors such as golden eagles, red-tailed hawks, osprey, and great horned owls enable them to simultaneously touch energized and/or grounded parts, potentially resulting in electrocution. Although raptors are most often considered when addressing electrocution risk, other birds such as crows, ravens, magpies, small flocking birds and wading birds can also be electrocuted. Closely-spaced exposed equipment, such as jumper wires on transformers, can pose an electrocution risk to small birds such as magpies or jays. Wading birds, such as herons, egrets, ibis, or storks, may require increased vertical spacing between lines, as they may exceed 40 inches in height.

Factors Influencing Collisions

Factors that influence collision risk can be divided into three categories: those related to avian species, those related to the environment, and those related to the configuration and location of lines. Species-related factors include habitat use, body size, flight behavior, age, sex, and flocking behavior. Heavy-bodied, less agile birds or birds within large flocks may lack the ability to quickly negotiate obstacles, making them more likely to collide with overhead lines. Likewise, inexperienced birds as well as those distracted by territorial or courtship activities may collide with lines. Environmental factors influencing collision risk include the effects of weather and time of day on line visibility, surrounding land use practices that may attract birds, and human activities that may flush birds into lines. Line-related factors influencing collision risk include the configuration and location of the line and line placement with respect to other structures or topographic features. Collisions often occur with the overhead static wire, which may be less visible than the other wires due to its smaller diameter.

Why Protect Birds?

All migratory birds in North America are protected under the Migratory Bird Treaty Act of 1918, as amended. In addition, both North American eagle species are protected under the Bald and Golden Eagle Protection Act (BGEPA), as amended. These laws provide civil and criminal penalties for the “take” of such species. “Take” under MBTA is defined as to “pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt any of these acts.” Take under BGEPA is defined as to “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” The bald eagle is also currently (April 2005) listed as threatened under the Endangered Species Act in the contiguous 48 states.

Power line electrocutions are a cause of mortality for raptors, eagles and other migratory birds. These deaths, many of which could be avoided by making relatively inexpensive modifications to existing power lines and poles, can cause power outages that inconvenience customers, spark grass and forest fires, and result in lost revenue and other costs to utilities.

Government agencies, conservation organizations, and the general public are concerned about avian safety. Industry and the public expect reliable electric service. These concerns and expectations have generated great public demand for both higher service reliability and better protection of avian populations and their habitats.

The electric power industry has long been aware that closely-spaced electric conductors, separated by a horizontal crossarm, can result in the electrocution of raptors and other birds. Thirty years ago, electric companies, USFWS, and interested nongovernmental organizations developed the first edition of *Suggested Practices for Raptor Protection on Power Lines*, which detailed how to reduce or eliminate the risk of avian electrocutions. Since the first *Suggested Practices*, utilities and agencies have worked cooperatively to identify electrocution and collision risks and improve the technology and methods used for reducing such risks.

The development of APPs by electric utilities will represent the continuation of an approach that emphasizes long-term proactive conservation partnerships between the utility industry, the conservation community, and USFWS. These voluntary plans will provide a framework for addressing electrocution hazards, committing utilities to evaluate their power lines and work with USFWS to conserve federally protected migratory birds.

III. APPLICABLE REGULATIONS

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), which is administered by USFWS, is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute wherein proof of intent is not an element of a taking violation. Wording is clear in that most actions that result in a "taking" or possession (permanent or temporary) of a protected species can be a violation.

Specifically, the MBTA states: "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird … (The Act) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."

A 1972 amendment to the MBTA resulted in inclusion of bald eagles and other birds of prey in the definition of a migratory bird. The MBTA provides criminal penalties for persons who, by any means or in any manner, pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird. The MBTA offers protection to 836 species of migratory birds, including waterfowl, shorebirds, seabirds, wading birds, raptors, and passerines. Generally speaking, the MBTA protects all birds occurring in the U.S. in the wild except for house (English) sparrows, European starlings, rock doves (pigeons), any recently listed unprotected species in the Federal Register and non-migratory upland game birds.

For a complete list of species protected under the MBTA see http://migratorybirds.fws.gov/intrnltr/mbta/mbtintro.html.

A violation of the MBTA by an individual can result in a fine of up to $15,000 and/or imprisonment for up to six months for a misdemeanor, and up to $250,000 and/or imprisonment for up to two years for a felony. Fines may be doubled for organizations. Penalties increase greatly for offenses involving commercialization and/or the sale of migratory birds and/or their parts.

Under authority of the **Bald and Golden Eagle Protection Act** (16 U.S.C. 668-668d; BGEPA), bald and golden eagles are afforded additional legal protection. Penalties for the "take" of an eagle may result in a fine of up to $100,000 and/or imprisonment for up to one year. The BGEPA has additional provisions wherein the case of a second or subsequent conviction of the BGEPA, penalties may be imposed of up to $250,000 fine and/or two years imprisonment.

The **Endangered Species Act** (16 U.S.C. 1531-1544; ESA) was passed by Congress in 1973 in recognition that many of our Nation's native plants and animals were in danger of becoming extinct. The purposes of the Act are to protect these endangered and threatened species and to provide a means to conserve their ecosystems. To this end, Federal agencies are directed to utilize their authorities to conserve listed species, and make sure that their actions do not jeopardize the continued existence of these species. Federal agencies are encouraged to do the same with respect to "candidate" species which may be listed in the near future. The law is administered by USFWS and the Commerce Department's National Marine Fisheries Service (NMFS). USFWS has primary responsibility for terrestrial and freshwater organisms, while NMFS has responsibility for marine species such as whales and salmon. These two agencies work with other agencies to plan or modify Federal projects so that they will have minimal impact on listed species and their habitats. Protection of species is also achieved through partnerships with the States, with Federal financial assistance and a system of incentives available to encourage State participation. USFWS also works with private landowners, providing financial and technical assistance for management actions on their lands to benefit both listed and non-listed species.

Section 9 of the ESA makes it unlawful for a person to "take" a listed species. Take is defined as ". . . to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The Secretary of the Interior, through regulations, defined the term "harm" as "an act which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." However, permits for "incidental take" can be obtained from USFWS for take of endangered species which would occur as a result of an otherwise legal activity.

Section 10 of the ESA allows for the development of "Habitat Conservation Plans" for endangered species on private lands or for the maintenance of facilities on private lands. This provision is designed to assist private landowners in incorporating conservation measures for listed species with their land and/or water development plans. Private landowners who develop and implement an approved habitat conservation plan can receive an incidental take permit that allows their development to proceed.

While the Service generally does not authorize incidental take under these Acts, USFWS realizes that some birds may be killed even if all reasonable measures to avoid the take are implemented. USFWS Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries who seek to minimize their impacts on migratory birds. Unless the take is authorized, it is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

State Regulations

Individual states may have regulations that protect avian species and a utility should consult with their respective State resource agency(s) to determine what regulations apply and if permits are required.

IV. APP PRINCIPLES

The following chapter provides guidance for implementation of each of the APP principles listed below:

- Corporate Policy
- Training
- Permit Compliance
- Construction Design Standards
- Nest Management
- Avian Reporting System
- Risk Assessment Methodology
- Mortality Reduction Measures
- Avian Enhancement Options
- Quality Control
- Public Awareness
- Key Resources

CORPORATE POLICY

The following are examples of utility Bird Management Policies. These policies have been included as examples to aid other utilities if they choose to develop a bird program policy.

Example 1. PacifiCorp's Bird Program Policy.

PacifiCorp Bird Management Policy

Bird interactions with power lines may cause bird injuries and mortalities, which, in turn, may result in outages, violations of bird protection laws, grass and forest fires, or raise concerns by employees, resource agencies and the public.

This policy is intended to ensure compliance with legal requirements, while improving distribution system reliability. PacifiCorp management and employees are responsible for managing bird interactions with power lines and are committed to reducing the detrimental effects of these interactions.

To fulfill this commitment, PacifiCorp will:

- ♦ Implement and comply with its comprehensive Avian Protection Plan (APP).
- ♦ Ensure its actions comply with applicable laws, regulations, permits, and APP procedures.
- ♦ Document bird mortalities, problem poles and lines, and problem nests.
- ♦ Provide information, resources, and training to improve its employees' knowledge and awareness of the APP.
- ♦ Construct all new or rebuilt lines in rural areas (outside city limits or beyond residential/commercial developments) and in areas of known raptor use, where appropriate, to PacifiCorp raptor-safe standards.
- ♦ Retrofit or modify power poles where a protected bird has died. Modifications will be in accordance with APP procedures.
- ♦ Participate with public and private organizations in programs and research to reduce detrimental effects of bird interactions with power lines.

PacifiCorp customer service and regulatory compliance will be enhanced and risk to migratory birds will be reduced through the proactive and innovative resolutions of bird power line interactions guided by this policy.

Signature, Executive Vice President________________________ Date_______________

Example 2. Southern California Edison's Policy and Procedures.

Avian Protection On or Near Power Lines

1.0 PURPOSE

One or more state and federal laws legally protect many species of birds in SCE's service territory. In order to ensure SCE's compliance with laws and regulations protecting these birds, it is necessary to have procedures in place that will allow SCE to determine where impacts are most likely to occur, what additional measures may need to be implemented to achieve compliance, if mitigation of impacts is needed, and to undertake other activities to facilitate protection of these legally protected birds on or near SCE power lines, substations and other facilities. This document is not intended to set out the specific legal requirements of all laws dealing with birds. Rather, this standard is intended to provide a process for achieving compliance with those laws.

2.0 POLICY STATEMENTS

N/A

3.0 REFERENCES

3.1 ESM 02.002.01, Environmental Policy

3.2 Endangered Species Alert Program Manual

3.3 SCE Distribution Overhead Construction Standards

4.0 OPERATIONS

4.1 Reporting

Raptor electrocutions and power line collisions shall be reported to Environmental Affairs (EA) within 24 hours of discovery of a carcass, using the current reporting mechanism or form. Non-raptor electrocutions and collisions will be reported using the Transmission and Distribution (T&D) Morning Report. Questions concerning reporting of other electrocutions of other animals should be referred to Environmental Affairs or your local T&D Environmental Specialist for guidance.

4.2 Retrofitting of Existing Structures

Any SCE power line structure involved in the electrocution of any eagle, endangered/threatened bird species, or other raptor species will be evaluated to determine if it is raptor safe. If not, the structure will be modified within 30 business days or sooner (for eagles or listed species) to make them raptor-safe. Environmental Affairs should be notified if structures of a similar design and in similar habitat are located in the same vicinity of any electrocution. This will allow Environmental Affairs to work with T&D in determining if these other structures should also be retrofitted to be raptor safe. Structures in the area where clusters of electrocutions have occurred *(i.e.,* three or more electrocutions per USGS quad, or two or more electrocutions per circuit) should be examined for retrofitting. Environmental Affairs will work with T&D to identify these clusters, determine which poles may need to be retrofitted, and the appropriate retrofit required.

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Example 2 *(con't).*

As opportunities arise during routine operation and maintenance activities, T&D field personnel will retrofit exposed wires and surfaces, as appropriate, if they are capable of electrocuting raptors and other birds/wildlife. Retrofits may include, but are not limited to, installing approved bushing covers on transformers, insulator hoods, protective covering on jumper wires or taps, and making other modifications, as appropriate.

4.3 New Construction

All new or rebuilt power line structures within Raptor Concentration Areas (RCAs) will be of a raptor-safe construction. All new or rebuilt power line structures on land administered by the federal government (USFS, BLM, etc.) will be evaluated by T&D and Environmental Affairs to determine if it should be made raptor safe. Environmental Affairs has identified and mapped RCAs, and will provide guidance on safe designs and copies of RCA maps.

4.4 Monitoring

Environmental Affairs shall monitor raptor mortality and direct appropriate corrective action.

4.5 Nest Protection

All activity involving active nests on SCE facilities will be coordinated with Environmental Affairs and the local T&D Environmental Specialist. Prior to trimming trees, Line Clearing personnel will inspect the trees during the nesting season (January through August) for nests, and avoid any trees with active *(i.e.,* eggs or young birds present) nests. If the trees with nests present an emergency, then Environmental Affairs Land Services will be contacted. Avoiding trees is especially important in the vicinity of riparian areas (streams, creeks or other water bodies). Line Clearing personnel will make every attempt to schedule tree-trimming activity to avoid riparian areas during the nesting season.

4.6 Training

All appropriate T&D field personnel will receive training on avian protection issues annually. All appropriate T&D contractors will receive some level of training on natural resources issues and will have contractual obligations to abide by this training.

5.0 MAINTENANCE

N/A

6.0 ATTACHMENTS

N/A

EFFECTIVE DATE
Operation & Maintenance Policy & Procedures Manual
SCE Internal
EN-5 New: 10-29-2002
APPROVED
AVIAN PROTECTION ON OR NEAR POWER LINES

Page 2 of 2

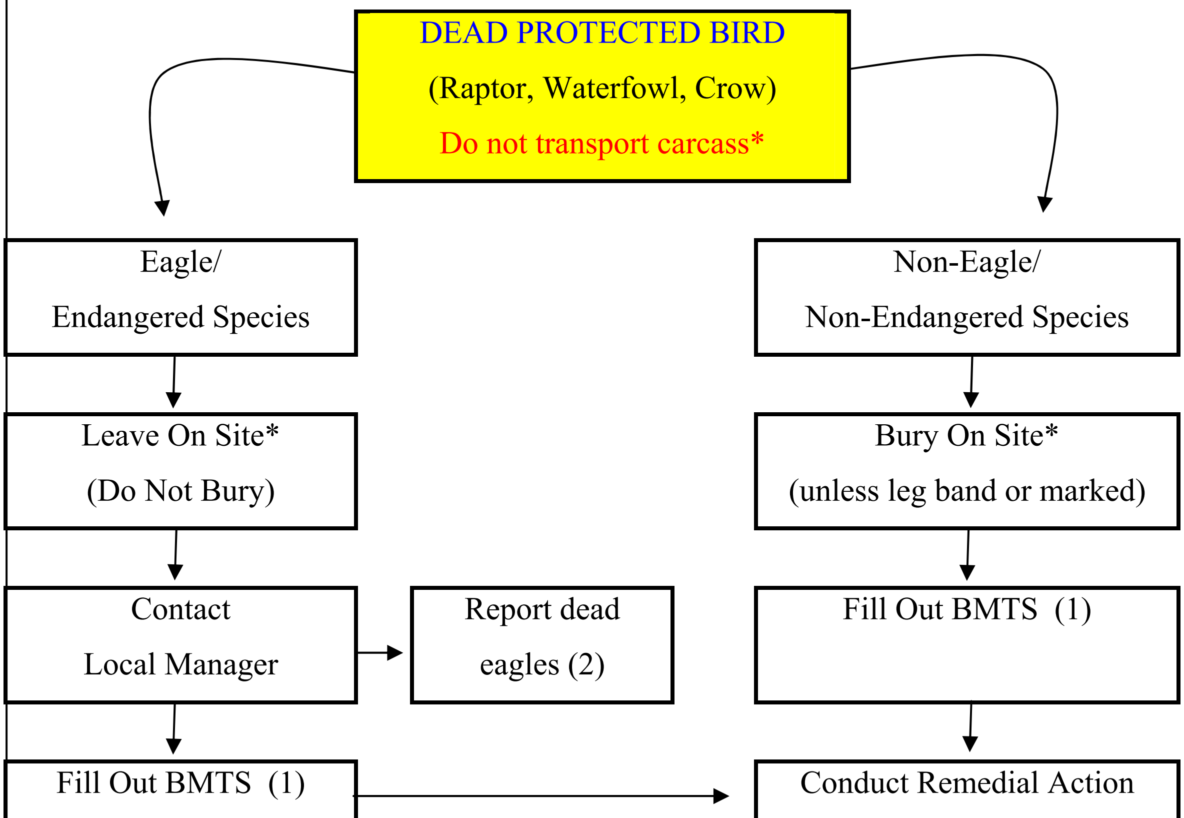
TRAINING

Training is an integral component of an APP. Workshops and short courses on avian/power line interactions are provided by APLIC (http://aplic.org) and EEI (http://eei.org). A two-hour overview of avian electrocutions and collisions intended for training use is also available through the APLIC website as part of the APP "tool box."

The following are examples of PacifiCorp and Southern California Edison training materials, including:

- Flow diagrams of company procedures for bird and nest management that can be distributed to field personnel as part of employee training.
- A brochure describing electrocution and nest issues and company raptor protection procedures.
- A brochure describing nest management procedures and protection.

Example 3. Bird mortality flow diagram based on PacifiCorp training materials.[*]



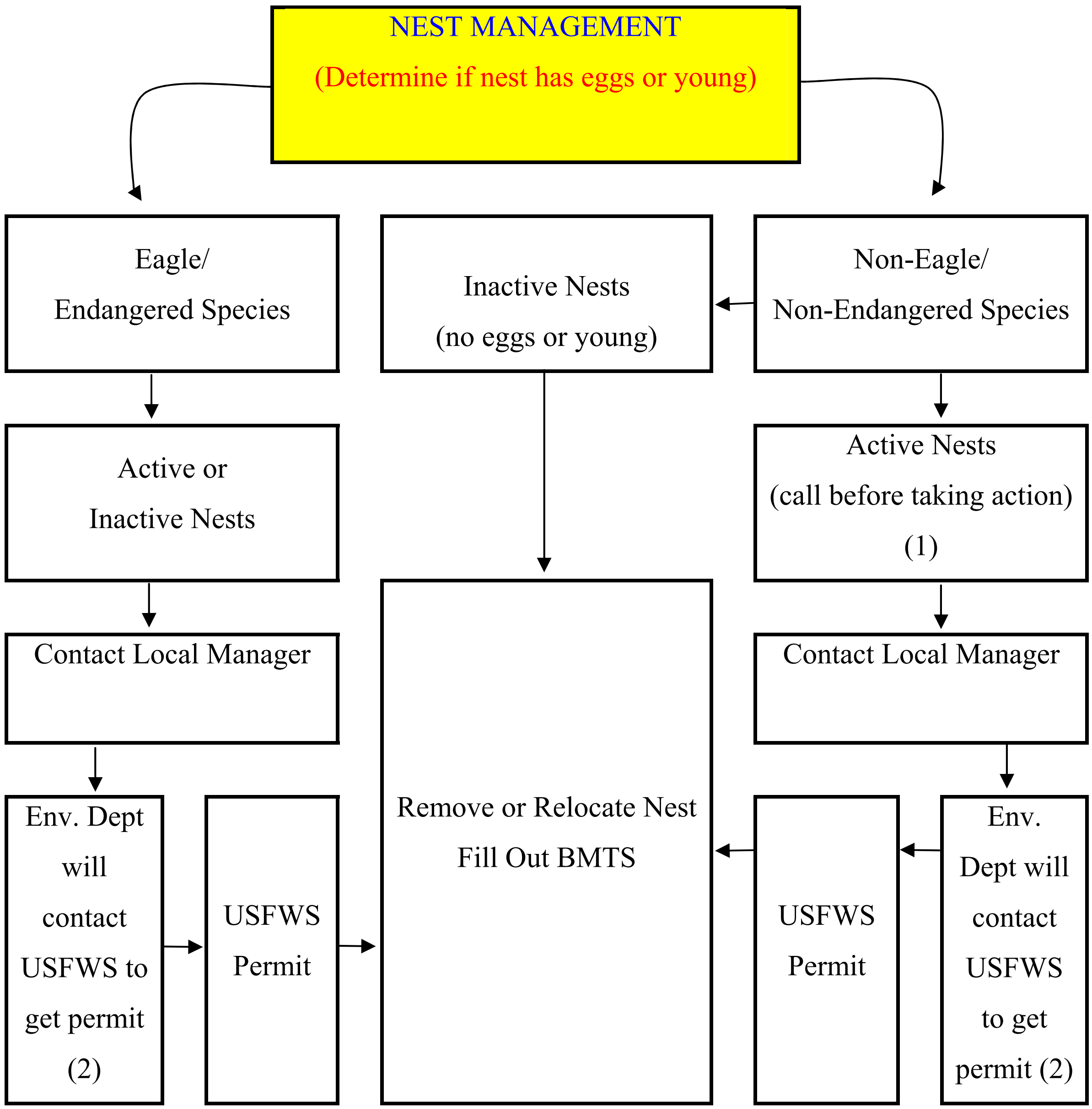
(1) Bird mortality information is entered in Company's Bird Mortality Tracking System (BMTS)

(2) Contact Environmental Dept. or USFWS if eagle or banded bird

Injured birds should be reported to local fish & game office or Environmental Dept.

[*] *Individual utility permits may contain different conditions regarding transport or salvage.*

Example 4. Nest management flow diagram based on PacifiCorp training materials.*



(1) If Imminent Danger conduct necessary action first; then call USFWS immediately.
(2) Contact Environmental Dept. or USFWS/State agency to request necessary permit for active nest or eagle nest removal/relocation.

* *Individual utility permits may contain different conditions regarding nest management.*

Example 5. "Raptor Protection Program" brochure, Southern California Edison.

SOUTHERN CALIFORNIA
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RAPTOR PROTECTION PROGRAM

Raptor Protection Program Goals

Raptors, or birds of prey, are meat-eating birds that include the hawks, eagles, and owls. Most species of raptors are protected under one or more laws and/or regulations.

Edison's Raptor Protection Program is designed to:

1. Reduce impacts to raptors.
2. Ensure compliance with state and federal laws and rules and regulations protecting these species.
3. Gather and provide information from operating divisions within Edison to Environmental Affairs on facility-caused electrocutions. This information will assist Environmental Affairs in responding to regulatory agency inquiries and provide informed responses to concerns expressed by the public.
4. Assist Company biologists in identifying problem areas where raptor protection may be required. Selectively identify and install cost-effective raptor protection devices to ensure Company compliance with existing laws and regulations.
5. Help identify and isolate where bird-caused outages occur so that these can be minimized, providing higher levels of quality service to our customers.

Example 5 *(con't).*

Raptor Protection

Electrocutions

Raptors often perch or nest on transmission or distribution towers or poles. Occasionally, the birds will make accidental contact between phases or phase and ground, causing harm to or electrocuting the bird. These electrocutions are most common on distribution or subtransmission facilities where energized conductors are close together.

The number of electrocutions can be decreased by either designing the line to minimize contact between phases, or by retrofitting existing lines where necessary with a protective device that prevents this contact. Studies have demonstrated that raptors prefer certain poles for nesting and perching. By identifying these preferred poles, we can modify them, and thus greatly diminish the potential for raptor electrocutions in a cost-effective manner.

Nest Protection

In the absence of other suitable nest sites, raptors often use transmission towers and distribution poles for nesting. State and federal laws and regulations protect these nests from removal at certain times of the year without necessary permits. It is important that nests not be disturbed when eggs or young birds are in them.

Raptor Protection Program Procedures

1. All incidents of facility-related raptor mortality should be reported to your supervisor. You should then fill out the raptor mortality report form available in all district offices or from your supervisor. The completed form should be sent to Environmental Affairs in the General Office.
2. From February through June, nests should not be removed or disturbed. Under no circumstances should known eagle nests be disturbed at any time of the year.
3. If a nest is discovered during this February–June period that presents a hazardous situation for the continued safe operation of the line, try to trim the nest rather than remove it. If a nest must be removed, call Environmental Affairs. Environmental Affairs possesses or will obtain the necessary permits for removing nests.
4. If at any time you have questions regarding these procedures, please discuss them with your supervisor or call Environmental Affairs, Dan Pearson at PAX 29562, or Janet Baas at PAX 29541.

Example 6. "Protection of Breeding Bird Nest Sites" brochure, Southern California Edison.

What to Do if You Are Working in Sensitive Areas or Find an Active Nest

- Avoid tree or shrub trimming to the extent feasible during the nesting season, especially in sensitive areas (riparian or sage scrub habitats).
- Limit noise during the nesting season to the extent feasible by turning off equipment when not in use and/or using equipment with mufflers.
- If a nest is found, **carefully** determine if the nest is active, that is, if it contains eggs or young. Do not touch the nest or its contents.
- If young are inadvertently knocked out of a nest or are found on the ground after trimming **call Environmental Affairs (EA) immediately.** If the young are small and the nest can be found and is intact, the young may be carefully replaced in the nest (using gloves). If the young are large and active or the nest can not be found or is not intact, the young should be protected and kept warm, if possible. EA will contact a rehabilitation expert for pick up.
- CONTACT EA IF YOU MUST WORK IN A SENSITIVE AREA DURING THE NESTING SEASON OR ENCOUNTER AN ACTIVE NEST THAT MUST BE REMOVED, TRIMMED, OR MAY BE DISTURBED BY VEGETATION CLEARING ACTIVITIES OR TO PROTECT PUBLIC HEALTH AND SAFETY. Note: eagle nests may never be removed or relocated at any time of year without clearance from the US Fish and Wildlife Service and the California Department of Fish and Game. Contact EA if it is necessary to handle an eagle nest in any way.

What to Do if You Have Questions

If you have any questions, such as whether or not you are working in a sensitive area, if there is the potential for sensitive species to be nesting where you will be working, or you find an active bird nest while you are working, contact your supervisor (first) or any of the following EA personnel:

Tracey Alsobrook	PAX 27547 or (626) 302-7547
Janet Baas	PAX 29541 or (626) 302-9541
Jill Fariss	PAX 28545 or (626) 302-8545
Dan Pearson	PAX 29562 or (626) 302-9562

Outside of normal business hours, you may contact these people through the Edison operator. All may be contacted by pager.

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PROTECTION OF BREEDING BIRD NEST SITES

Why SCE is Concerned About Bird Nests

Pygmy owl (Cavity nest)

Example 6 *(con't).*

Virtually all birds in North America are protected by one or more state or federal laws. SCE must be in compliance with all laws and regulations protecting birds, their habitat, and nest sites. It is illegal to, among other things, pursue, hunt, harass, kill, or collect any migratory or listed bird species, including their eggs or nest. Fines and penalties, including jail, can be substantial for non-compliance.

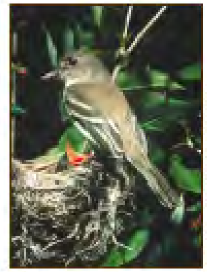
When and Where Birds Nest

Most birds nest during the period from mid-February through August. The specific timing depends on several factors such as species of bird, its nest location (altitude and latitude), abundance of food, and weather. Birds nest in a wide variety of habitats, such as riparian areas (along streams, creeks, ponds), forests, beaches, deserts, and foothills. That is, anywhere adequate shelter and food for young can be found. Nesting sites within these habitats include trees, shrubs, holes and cavities in trees or dirt embankments, on cliff ledges, on the ground, and utility poles and towers.

Screech owl
(Cavity nest)

Killdeer
(Ground nest)

Cactus wren
(Twiggy mass in cactus or yucca)



Willow Flycatcher
(Small cup in willow shrubs)

Red-tailed hawk
(Moderately large twiggy nest in tall trees or other elevated locations)

Nest sizes range from very large, obvious structures made by eagles, to very small, inconspicuous, and camouflaged ones used by hummingbirds.

Bald eagle
(Branches in large tree or on rocky outcrop)

Anna's hummingbird
(Tiny cup in a shrub)

How to Locate and Avoid Disturbing Nesting Birds

- Be aware of when birds nest (**generally** mid-February through August).
- Be aware when working in especially sensitive habitats, such as riparian and sage scrub (at least partly natural areas with somewhat woody shrubs, below about 3,000 feet).
- Note any bird activity within shrubs or trees. If a bird appears agitated or reluctant to leave an area, it may indicate a nearby nest.
- Many nests are found between the ground and 10 meters high in shrubs and trees.
- Look for small dark, generally cup-shaped masses among the branches of shrubs or both small and larger masses in trees.
- Prior to trimming or cutting down trees, look for holes or cavities that may contain nests.

PERMIT COMPLIANCE

A company should work with resource agencies to determine if permits are required for their operational activities that may impact protected avian species. Particular attention should be given to specific activities that can require Special Purpose or related permits, including, but not limited to, nest relocation, temporary possession, depredation, salvage/disposal, and scientific collection.

While it is recommended that each utility developing an APP familiarize itself with the different permit types and their provisions located in 50 CFR part 21 (http://access.gpo.gov/nara/cfr/waisidx_03/50cfr21_03.html), it is highly recommended that the utility make initial contact with the Migratory Bird Permit Examiner located in the USFWS Region where the utility is specifically planning to implement its APP. The Migratory Bird Permit Offices in each of the USFWS's seven Regions are listed on pages 69 and 70 of the Key Resources section.

To acquire a permit application, contact the Migratory Bird Permit Office in the Region where your business is headquartered or in the Region (if it is different) where you propose to implement your APP. Information about Regional boundaries can be accessed at htpp://permits.fws.gov/mbpermits/birdbasics.html then click on Regional Bird Permit Offices, for locations and addresses (listed on pages 69 and 70 in the Key Resources section).

State permits may also be required to manage protected bird nests or for temporary possession of avian species. Specific information on required permits should be obtained from your State resource agency (see Key Resources, pages 76-78, for State agency contacts). Both State and Federal agencies should be consulted as you develop your APP.

Migratory Bird Treaty Act and Migratory Bird Permits

USFWS Regional offices administer permits for qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, rehabilitation, conservation education, migratory game bird propagation, salvage, take of depredating birds, taxidermy, and waterfowl sale and disposal. These offices also administer permit activities involving bald and golden eagles, as authorized by the BGEPA.

The MBTA makes it illegal for anyone, including individuals, companies, or agencies, to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except (1) under the terms of a valid permit issued pursuant to Federal regulations or (2)under the terms of a regulation not requiring a permit. The migratory bird species protected by the Act are listed in 50 CFR 10.13 (this list is available online at http://migratorybirds.fws.gov/intrnltr/mbta/mbtintro.html).

Migratory bird permit policy is developed by the Division of Migratory Bird Management and the permits themselves are issued by the Regional Migratory Bird Permit Offices. The regulations governing migratory bird permits can be found in 50 CFR part 13, General Permit Procedures (http://access.gpo.gov/nara/cfr/waisidx_03/50cfr13_03.html) and 50 CFR part 21, Migratory Bird Permits (http://access.gpo.gov/nara/cfr/waisidx_03/50cfr21_03.html).

Bald and Golden Eagle Protection Act and Eagle Permits

The two species of eagles that are native to the United States have additional protection under the BGEPA. Under the Act, USFWS issues permits to take, possess, and transport bald and golden eagles for scientific, educational, and Indian religious purposes, depredation, and falconry (golden eagles). No permit authorizes the sale, purchase, barter, trade, importation, or exportation of eagles, or their parts or feathers. The regulations governing eagle permits can be found in 50 CFR part 13, General Permit Procedures (http://access.gpo.gov/nara/cfr/waisidx_03/50cfr13_03.html) and 50 CFR part 22, Eagle Permits (http://access.gpo.gov/nara/cfr/waisidx_03/50cfr22_03.html).

Federally Listed Species (Endangered Species Act)

To obtain a list of all federally-listed (threatened and endangered) birds, or all federally-listed fauna and flora, consult 50 CFR part 17.11. This list is available online at http://endangered.fws.gov/wildlife.html.

Where power companies propose to construct power generation, transmission, or related equipment on Federal lands, the federal land management agency must first consult under Section 7 of the ESA with USFWS. Before initiating an action, the Federal action agency (the agency authorizing a specific action) or its non-Federal permit applicant (the power company), must ask USFWS for a biological opinion (if a listed species could be impacted) and to provide a list of threatened, endangered, proposed, and candidate species and designated critical habitats that may be present in the project area. USFWS has developed a handbook describing the consultation process in detail, which is available at http://endangered.fws.gov/consultations.

When non-Federal activities (activities not on Federal lands and/or lacking a Federal nexus such as Federal funding) could result in a take of threatened or endangered species, an incidental take permit is required under Section 10 of the ESA. Some states may also have regulations that require issuance of permits or development of conservation plans. The standards for approval of an incidental take permit are found in section 10 of the ESA. Approval of an incidental take permit issued in conjunction with a Habitat Conservation Plan (HCP) requires the Secretary of Interior to find, after an opportunity for public comment, that among other things, the taking of ESA species will be incidental and that the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking. An HCP must accompany an application for an incidental take permit. The HCP associated with the permit is to ensure that there are adequate conservation measures to avoid jeopardy to the species. Information about consultations and HCPs can be obtained from the nearest USFWS Ecological Services Field Office, generally located in each state. A list of those offices and their phone numbers can be accessed at http://info.fws.gov/pocketguide.

CONSTRUCTION DESIGN STANDARDS*

In certain habitats that have power equipment and the potential for avian interactions, the design and installation of new facilities, as well as the operation and maintenance of existing facilities should be bird friendly. Inclusions of accepted construction standards for both new and retrofit techniques are highly recommended for inclusion in an APP. Companies can either rely upon construction design standards found in APLIC's *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* and *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*, or the most current editions of these documents, or may choose to develop their own internal construction standards that meet or exceed these guidelines. These standards should be used in areas where new construction should be avian-safe, as well as where existing infrastructure needs to be retrofitted. An APP bird policy may require that all new or rebuilt lines in identified avian use or problem areas be built to current safe standards. Implementing avian-safe construction standards in such areas will reduce future legal and public relations problems and enhance service reliability.

New Construction

Distribution, transmission and substation construction standards must meet National Electric Safety Code (NESC) requirements and should provide general information on specialized construction designs for avian use areas. Avian-safe construction, designed to prevent electrocutions, must provide conductor separation of 60 inches between energized conductors and grounded hardware, or must cover energized parts and hardware if such spacing is not possible. Some common examples of avian-safe construction and retrofit techniques to reduce electrocution risks are presented in this section. Additional information can be found in *Suggested Practices for Raptor Protection on Power Lines.*

In areas where birds frequently collide with conductors/ground wires, or where

* Only examples of common structure configurations are presented in these Guidelines. See current edition of *Suggested Practices* for additional configurations and recommendations.

agencies are concerned about the safety of protected birds (*e.g.*, near wildlife refuges), appropriate siting and placement of lines will reduce the likelihood of collisions. When possible, avoid siting lines in areas where birds concentrate (*e.g.*, wetlands, stream crossings, historic staging areas, roosts, and nesting colonies) and take advantage of vegetation or topography that naturally shields birds from colliding with the wires (*e.g.*, placement next to cliffs or trees). If this is not possible, installing visibility enhancement devices can reduce the risk of collision on new or existing lines (see pages 43-44). These devices include marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on the line design and location. The effectiveness of these devices has been validated by Federal and State agencies and independent researchers in conjunction with APLIC. Additional information may be found in *Mitigating Bird Collisions with Power Lines.* In some situations, the additional costs and reliability risk of under grounding a section of line may be justified.

Modification of Existing Facilities

Modification of existing facilities is necessary when dead and/or injured protected birds are found, where high-risk lines are identified, or concerns of legal compliance are at issue. A “problem pole” is one where there has been a documented avian collision, electrocution, problem nest material or where there is a high risk of an avian mortality. The need for this remedial action may result when "problem poles" are identified through bird mortality records or field surveys, or when the company is notified by agency representatives or concerned customers. System reliability concerns due to bird interactions may also result in requests from field operations staff. Retrofitting to prevent electrocutions could include: 1) covering jumper wires, conductors and equipment; 2) discouraging perching in unsafe areas; 3) reframing; or 4) replacing a structure.

The objectives of remedial action are to:

1. Prevent or reduce avian mortality and outages related to bird electrocutions, collisions, or nests;

2. Provide 60-inch minimum horizontal separation between energized conductors and/or energized conductors and grounded hardware;
3. Insulate hardware or conductors against simultaneous contact if adequate spacing is not possible;
4. Discourage birds from perching in unsafe locations;
5. Provide safe alternative locations for perching or nesting; or
6. Increase the visibility of conductors or shield wires to prevent avian collisions.

Site-Specific Plans

The factors that create a hazard for birds near power lines are complex and often site-specific. Therefore, the most efficient solution for correcting a problem line is a site-specific plan that satisfies unique local conditions (*i.e*., topography, avian populations, prey populations, land use practices, line configuration, adjacent wetlands, historical bird use areas, etc.). The plan is comprised of recommendations for the most appropriate remedial action to the poles or lines causing the problem, and should include a timetable for job completion. When a problem area or line is identified, a site meeting may be conducted with engineering and operations personnel to provide guidance on line modifications, and with company biologists or consultants to provide input on biological aspects of the affected species. The timeframe for action will be based on agency requests, public relations, budget, logistical and manpower constraints, as well as biological considerations that affect species vulnerability. The application of remedial measures to a few "problem poles" or spans can reduce problems over a wide area.

Electrocutions: Avian-Risk Designs

This section provides information about designs which have historically caused avian electrocution problems. These designs should be avoided in known raptor or other protected bird use areas and rural sites.

Most lines that electrocute raptors or other large birds are primary distribution lines. Problems occur most often when:

1. The distance between conductors is less than the wingspan or height of a landing or perching bird (see Figure 3).
2. Hardware or equipment cases are grounded and are in close proximity to energized conductors, energized parts or jumper wires (see Figure 4).

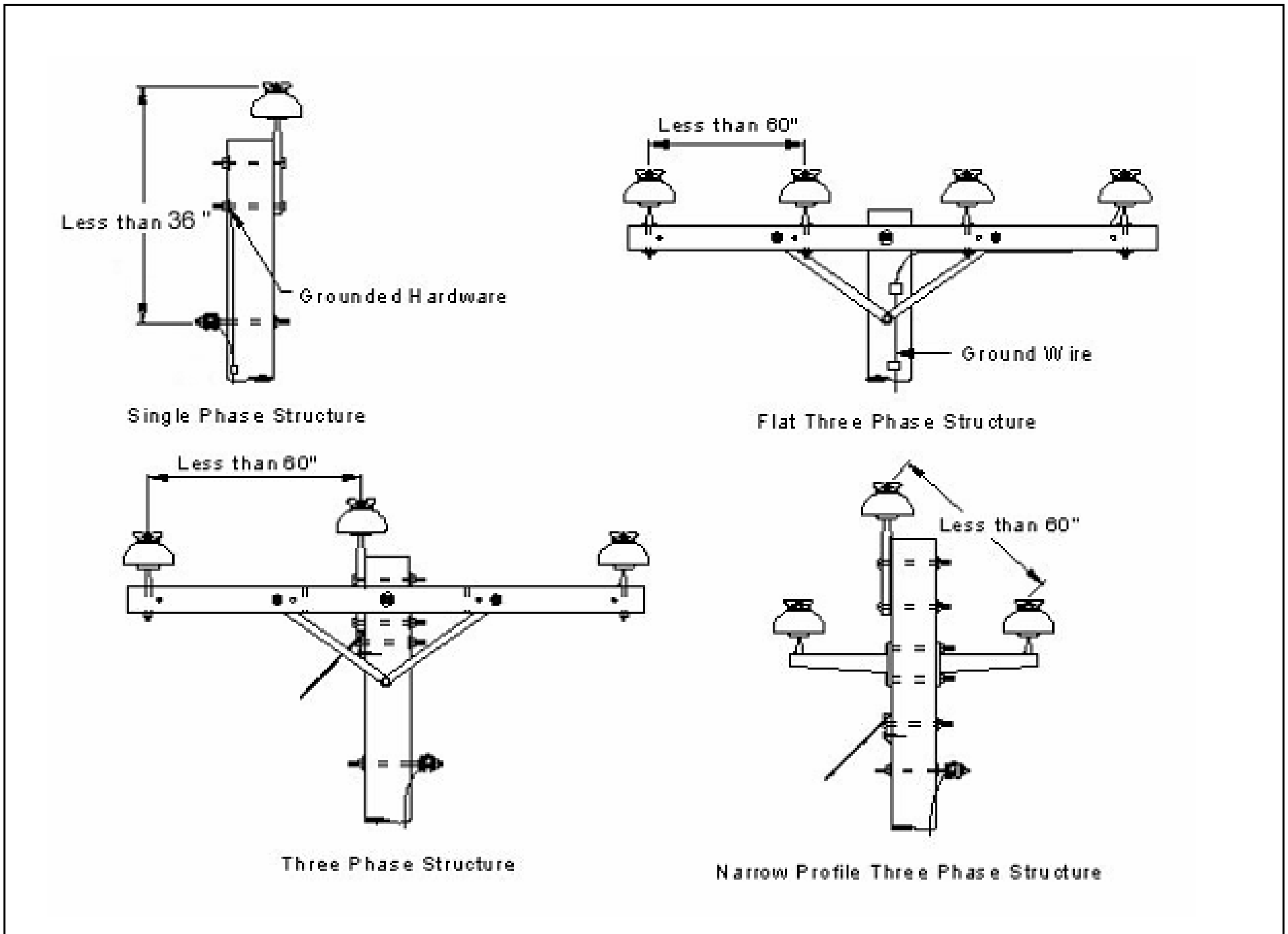


Figure 3. Typical avian-risk structures.

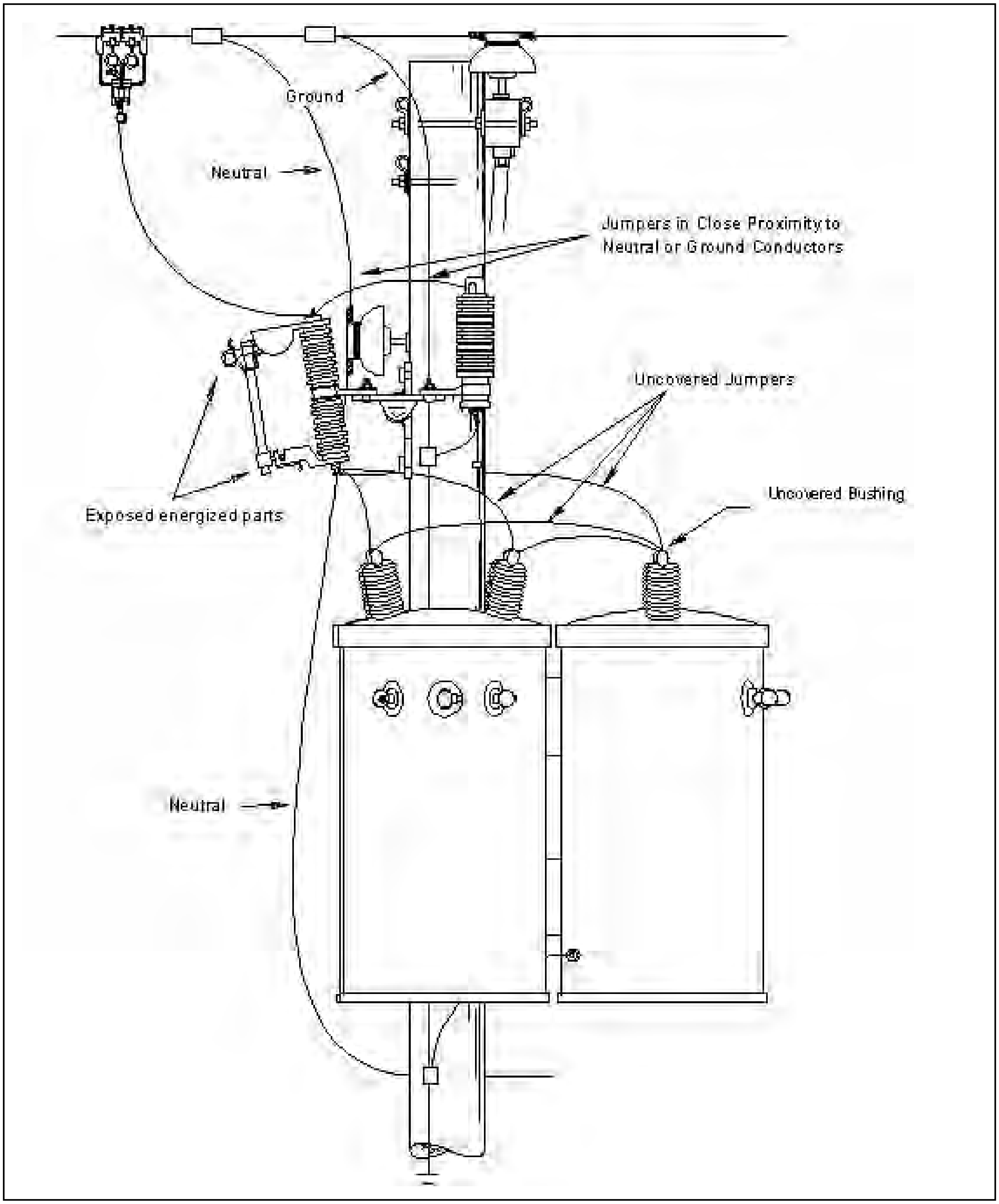


Figure 4. Typical avian-risk equipment structure.

Minimizing Electrocutions: Avian-Safe Designs and Modifications

This section provides information on designs and criteria for constructing new lines or rebuilding existing lines to avian-safe standards.

Proper Design of New Facilities

The following dimensions for primary structures are intended for use in areas with populations of raptors or other large birds or in rural sites (areas outside city limits or beyond incorporated areas with commercial or residential development). Nonetheless, avian-safe construction should be considered to improve system reliability and avian protection whenever it does not conflict with other considerations. When a new line or extension is designed, avian-safe standards for construction of the distribution system should be followed (see Figures 5 and 6 for typical safe designs).

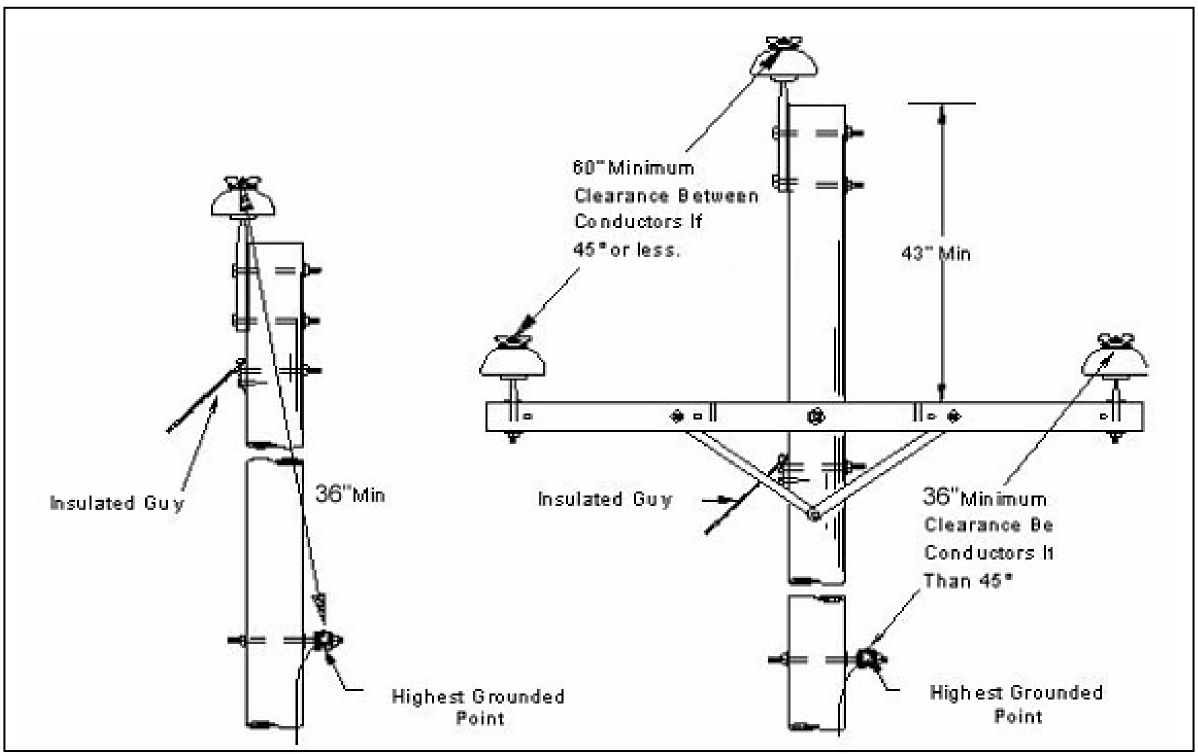


Figure 5. Typical avian safe structures: single phase (left), three-phase with lowered 8-foot crossarm (right).

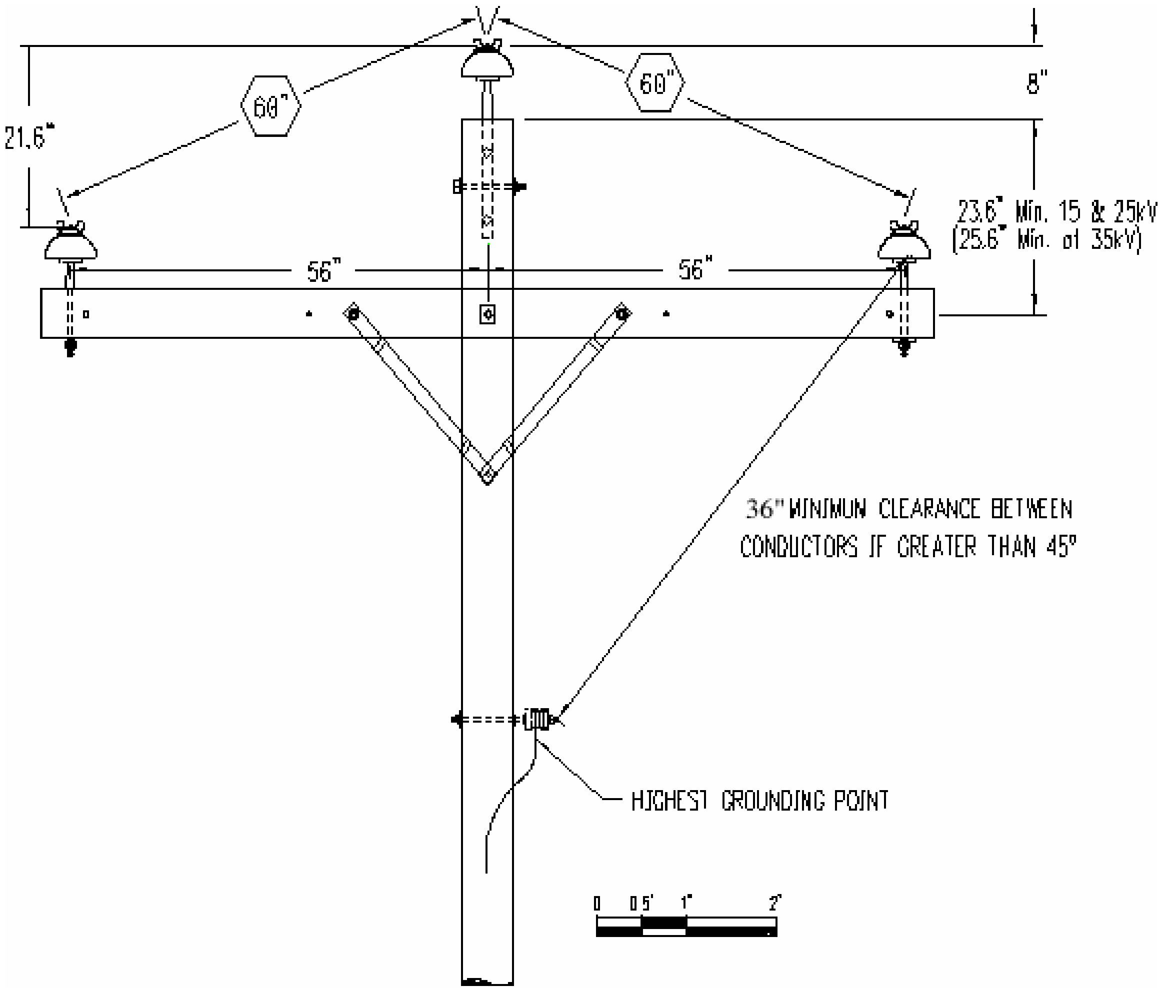


Figure 6. Typical three–phase avian-safe structure with 10–foot crossarm.

On single phase structures, a minimum vertical separation of 36 inches from phase to ground is needed to safely accommodate eagles and most wading birds (Figure 5). On three phase structures, a vertical clearance of at least 43 inches between un-insulated conductors, ground wires and grounded hardware on poles with 8-foot crossarms will provide the 60-inch required clearance (Figure 5). Separation can be accomplished by lowering crossarms and neutral attachments, or if vertical space is not available, an 8–foot crossarm can be replaced with a 10–foot arm (see Figure 6). If there is not enough pole height to drop the crossarm, a 10-foot crossarm can be the economical choice. Structural strength of the longer arm must be considered if the arm is replaced. Also, narrow rights-of-way may dictate the horizontal width of a crossarm, possibly requiring more pole height to achieve avian-safe spacing. Regardless of the configuration, hardware should not be grounded above the neutral position.

An alternate method for ensuring separation of energized conductors is to use vertical construction (see Figure 7). This is not the preferred method of separation, since considerable pole height is required to attain adequate clearance, making this an expensive solution. However, it may be useful in some situations, such as turning corners, where normal separation methods are not possible.

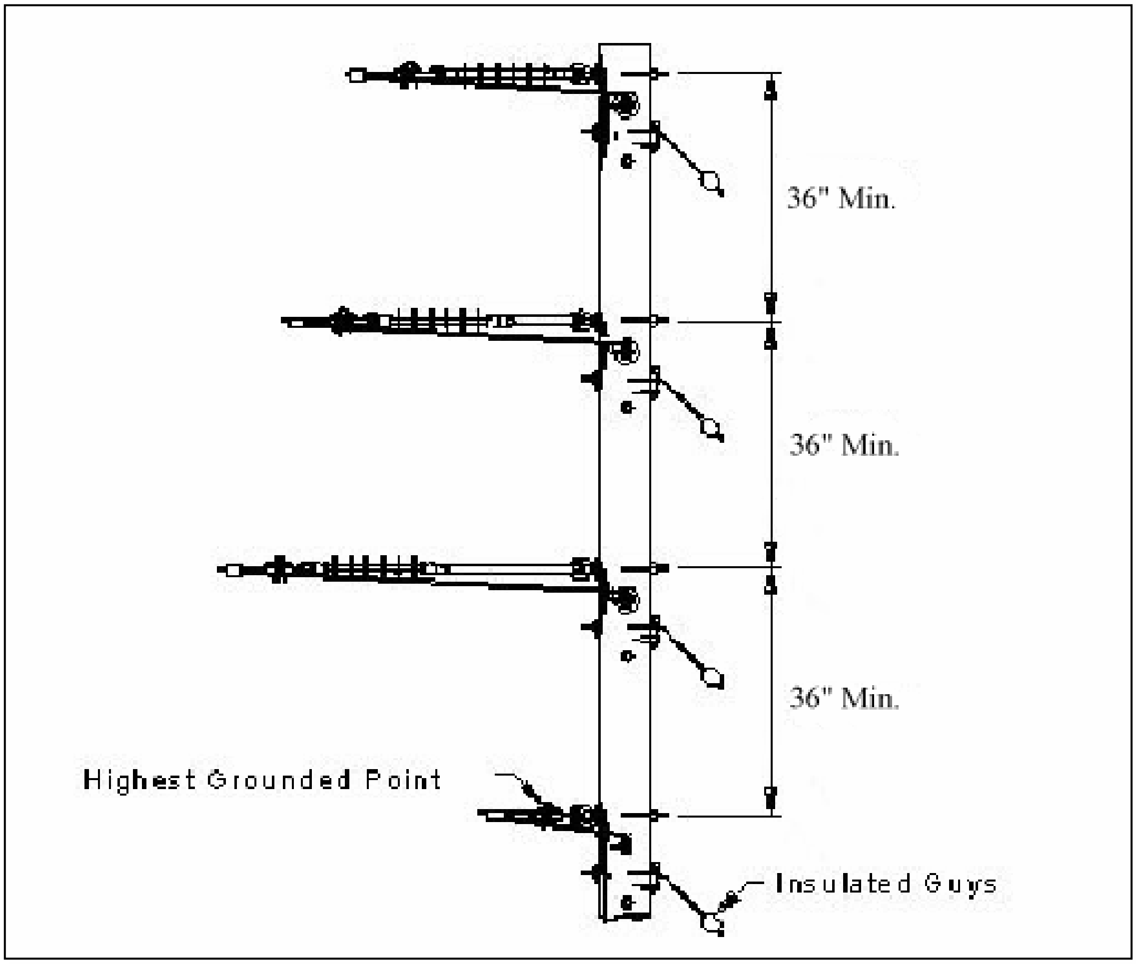


Figure 7. Typical avian-safe three-phase vertical corner configuration.

Modification of Existing Structures

On existing structures where raptors or other large birds have been electrocuted or injured, the preferred remedial measure is to provide 60–inch separation between energized conductors. Reframing using a 10–foot crossarm which allows 60–inch separation between conductors may be a suitable alternative to pole replacement.

However, pole replacement utilizing a safe design may be required on poles where bird mortalities have been documented and other safe modifications are not feasible due to pole height or condition.

Other remedial options include covering conductors and equipment or installing bird perch guards (triangles) or triangles with perches. These options do not offer total protection for birds, but may greatly reduce the chance of avian electrocutions. These options should be used when separation of the conductors is not possible, or where equipment is on the pole.

Perches and Guards

If conductor separation cannot be achieved and covering or reframing is impractical, perch guards (triangles) with optional perches may be used for large perching bird protection (Figure 8). Since raptors will often perch on the highest vantage point, the installation of perch guards between closely-spaced conductors and the placement of perches above existing arms and conductors may keep a bird from contacting energized parts or wires. Perches may not be effective when used without perch guards. Perches and guards, when properly installed, are not an absolute solution, but they do reduce the risk to birds. Ideally, when a perch guard is installed, an alternative, safe perch site should be provided. The open part of the crossarm, as shown in Figure 8, could serve as such a site. Perch guards are generally 18 to 22 inches wide and should not be used when conductor spacing is greater than 32 inches. When spacing is between 32 and 60 inches, use an insulator cover (see Figure 9) instead of a triangle or perch. Protective equipment should not be installed when conductors are more than 60 inches apart.

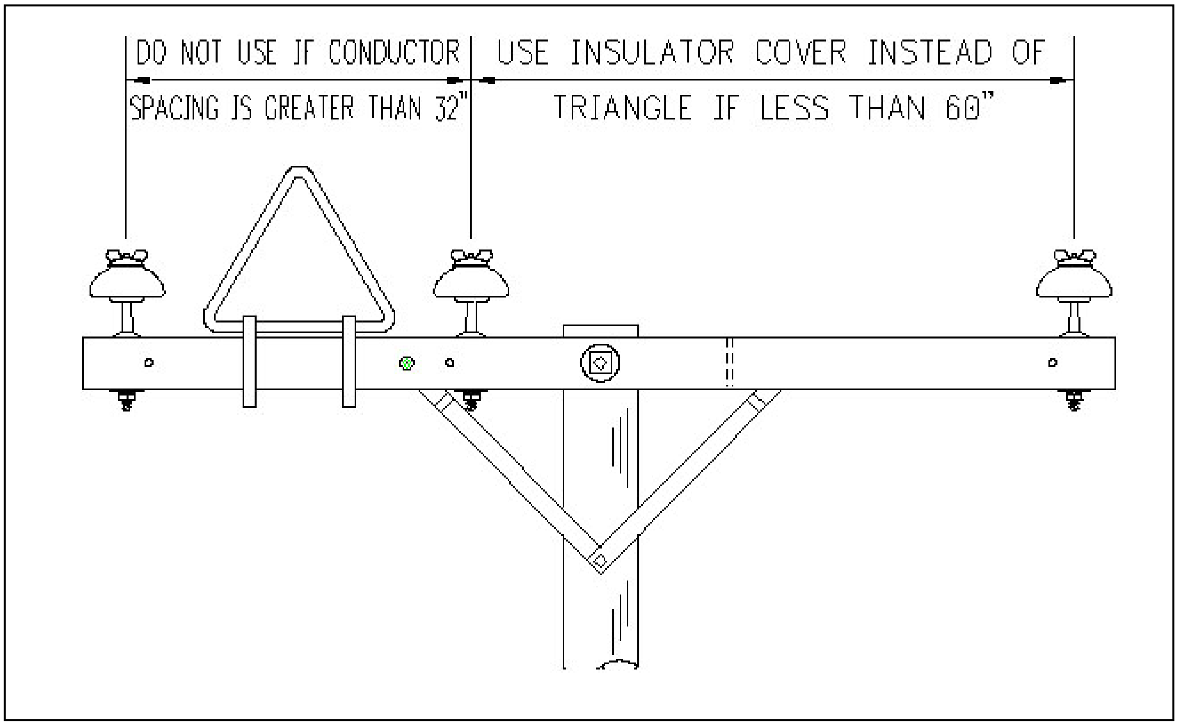


Figure 8. Properly installed perch guard.

Covering Conductors

Where adequate separation of conductors, or conductors and grounded parts, cannot be achieved, covering conductors may be the only solution short of reframing or replacing structures. Covering material should be used to cover both the conductor and the insulator. On three phase structures, the cover should extend a minimum of three feet from the pole top pin insulator (see Figure 9). Occasionally, on double circuits or distribution underbuild, a smaller (32 to 36-inch) one–piece cover may be used in areas where eagles or other large birds are absent. There are many manufactures of insulator covers. Insulator covers are similar to the temporary cover-ups used to protect crews working on energized lines. ***However, the products should not be used for human protection or considered as insulation.***

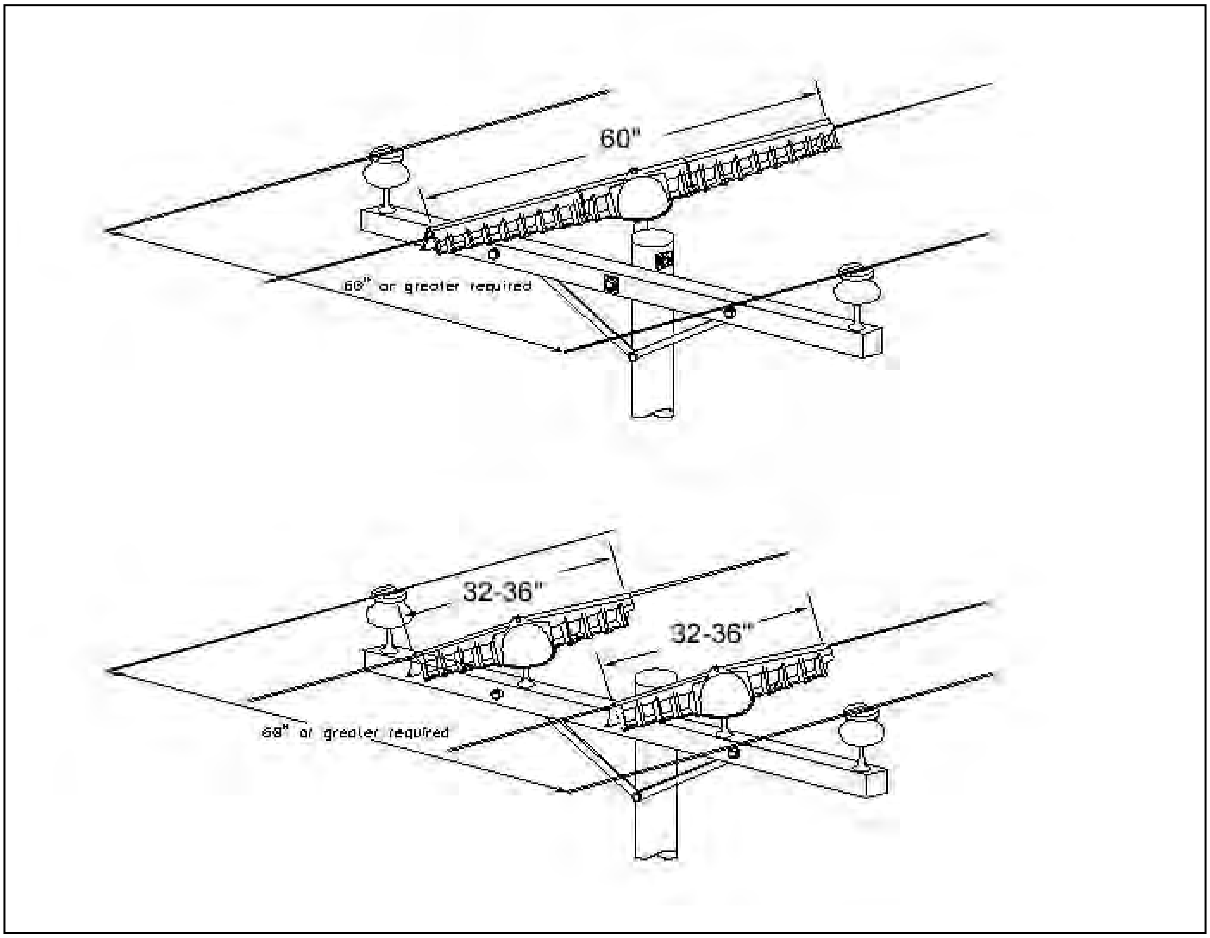


Figure 9. Conductor and insulator covers.

Covering Equipment Parts

If transformers, cutouts or other energized or grounded equipment are present on the structure, jumpers, cutouts and bushings should be covered to decrease the chance of a bird electrocution (Figure 10). For jumper wires, use a bird jumper wire guard, cover-up hose or insulated power cable. For cutouts, various covers are available to fit different sizes and styles of cutouts. For bushings, use a bushing guard that provides the protection needed. (*Note* - Your APP should include specifications on materials your utility will accept).

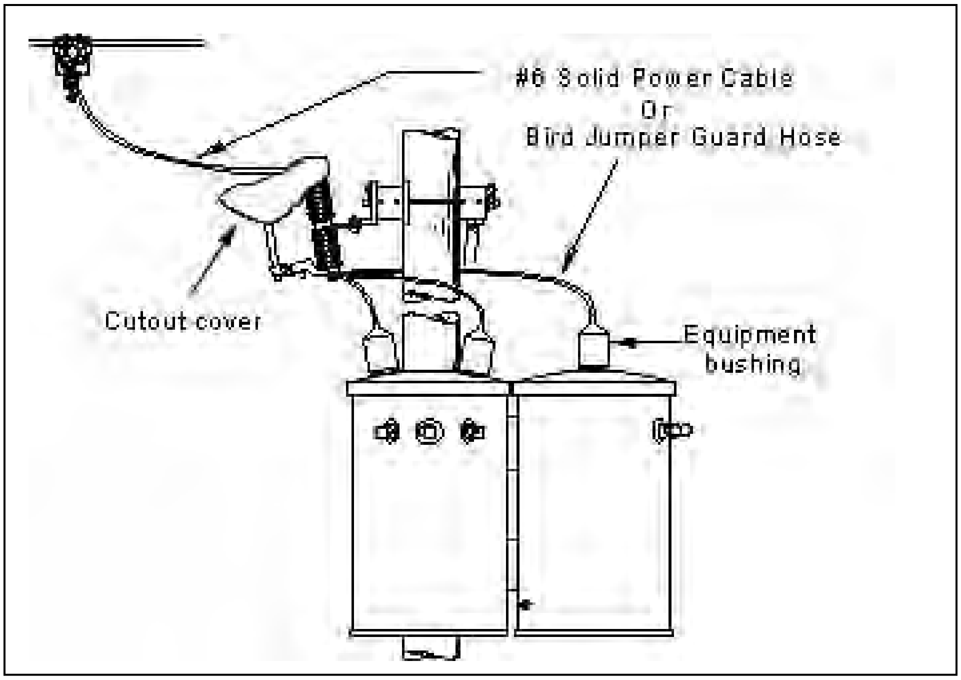


Figure 10. Hose and bushing caps.

Collisions: Bird Protection

The proximity of a line to high bird-use areas, vegetation that may attract the birds, and topographical features that affect local and migratory movements should be considered when determining the extent of necessary remedial action or when siting a new line. Avoiding construction of new lines in areas of high bird use may be the best way to prevent or minimize collision issues.

On existing lines, the risk of collision may be reduced or eliminated by burying or relocating the line, reconfiguring the line, removing the overhead ground wire, or marking the line to increase visibility. Because in most instances remediation of only a few spans will eliminate the problem, burying, relocating or reconfiguring the line are not cost-effective solutions. Removal of the overhead ground wire may not be feasible due to operational or safety concerns. However, research indicates that marking the shield wire (transmission lines) or conductors (distribution lines) to increase visibility significantly reduces the incidence of avian collisions.

Marker balls, swinging markers, bird flight diverters, or other similar devices are commercially available products designed to increase the visibility of overhead wires to birds. Examples of one type of swinging marker and a bird flight diverter are shown in Figure 11. While some older clamping devices could damage lines, some of the newer devices have been designed to prevent damage to lines.

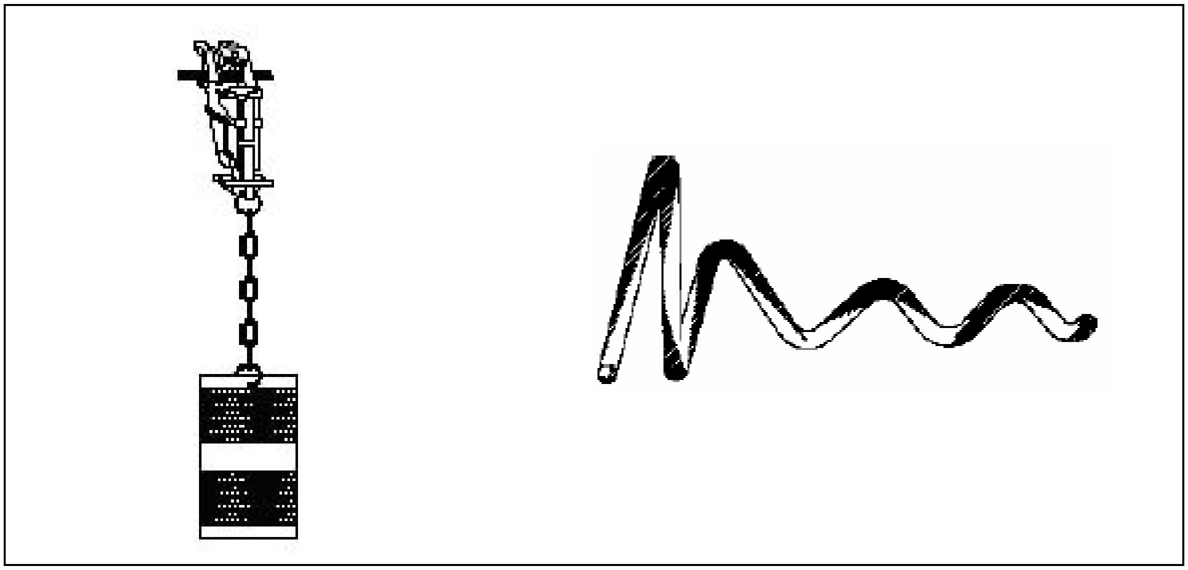


Figure 11. Swinging marker device (left) and bird flight diverter (right).

NEST MANAGEMENT

Raptors, and some other avian species, benefit from the presence of power lines by utilizing distribution poles and transmission structures for nesting. Although electrocution of birds that nest on transmission towers is infrequent, bird nests can cause operational problems. Removal of nests generally does not solve the problem because most species are site-tenacious and rebuild shortly after the nest material is removed. There are also regulatory and public relations components to nest removal (see Permit Compliance section for information on nest-related permits). Further, companies may experience public relations benefits by providing safe nesting locations. All active nests (eggs or young present) of designated migratory birds are protected by the Migratory Bird Treaty Act. A permit issued by USFWS may be required before managing an active nest. If a problem with a specific nest is anticipated, permit requirements may be avoided by removing the nest or taking the appropriate action during the non-breeding season while it is inactive (excluding eagles and endangered/threatened species). The breeding season and dates when nests may be active varies by location and species, but for most North American raptors falls between February 1 and August 31. However, a nest is considered active only when eggs or young are present. If there are questions whether a problem nest is active or inactive, company environmental staff, USFWS, or State wildlife agencies should be consulted.

A memorandum from USFWS on nest management and nest destruction is provided in Figure 12 (page 47). This document can also be accessed online at http://permits.fws.gov/mbpermits/PoliciesHandbooks/MBPM-2.nest.PDF.

Nesting platforms have proven to be valuable tools in dealing with problem nests, both in terms of reducing outages and increasing positive publicity. Nesting platforms are generally needed more often for problem nests on distribution poles (because of closely spaced conductors) than for those on transmission towers. Platforms provide for the needs of the birds, while preventing electrocutions and electrical outages. Artificial nesting substrates in a variety of designs are often accepted by nesting raptors, especially ospreys. Because birds usually tend to stay at the pole where the initial nesting attempt occurs, a nesting platform should be placed nearby on a new, non-energized pole and perch discourager(s) installed on the existing structure. The new nest platform pole should be as tall as or taller than the existing pole and should be placed adjacent to or near the existing pole with the problem nest. In some cases a new pole cannot be installed so a nest platform can be mounted above the crossarm. Mounting a nest platform above energized equipment is not encouraged because birds are likely to drop nest materials that could cause a fire or outage. Nest discouragers should be erected on the original nest pole to prevent birds from rebuilding. The existing nest, or other nesting material, should be relocated to the new platform to attract the birds. Nest platforms are commercially available or can be constructed with materials on hand such as wire spool ends or wooden pallets. In addition, volunteers can be solicited to construct nest platforms. Dimensions for a raptor nest platform are provided in the Avian Enhancement Options section (see Figure 14 on page 65). Additional designs can be found in *Suggested Practices.*

There may be times when nesting should be discouraged to prevent avian electrocutions or risks to electrical equipment. Concerns of local customers should be considered and proper placement of perch discouragers is important. Plastic or metal spike discouragers are not recommended to prevent nesting because they may actually provide a nest substrate attachment point for some species. PVC or fiberglass material perch discouragers, mounted on the crossarm, will usually prevent the placement of nesting material. See *Suggested Practices* for additional recommendations on nest deterrents.

Figure 12. USFWS memo on migratory bird nest destruction.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Washington, D C 20240
MBPM-2
Date: APR 15, 2003

MIGRATORY BIRD PERMIT MEMORANDUM

SUBJECT: Nest Destruction

PURPOSE: The purpose of the memorandum is to clarify the application of the Migratory Bird Treaty Act (MBTA) to migratory bird nest destruction, and to provide guidance for advising the public regarding this issue.

POLICY: The MBTA does not contain any prohibition that applies to the destruction of a migratory bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. To minimize MBTA violations, Service employees should make every effort to inform the public of how to minimize the risk of taking migratory bird species whose nesting behaviors make it difficult to determine occupancy status or continuing nest dependency.

The MBTA specifically protects migratory bird nests from *possession, sale, purchase, barter, transport, import,* and *export,* and *take.* The other prohibitions of the MBTA - *capture, pursue, hunt,* and *kill* - are inapplicable to nests. The regulatory definition of *take,* as defined by 50 CFR 10.12, *means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt hunt, shoot, wound, kill, trap, capture, or collect.* Only *collect* applies to nests.

While it is illegal to collect, possess, and by any means transfer possession of any migratory bird nest, the MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. The MBTA does not authorize the Service to issue permits in situations in which the prohibitions of the Act do not apply, such as the destruction of unoccupied nests. (Some unoccupied nests are legally protected by statutes other than the MBTA, including nests of threatened and endangered migratory bird species and bald and golden eagles, within certain parameters.)

However, the public should be made aware that, while destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs, is illegal and fully prosecutable under the MBTA.

Due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated degree of risk of violating the MBTA. For example, colonial nesting birds are highly vulnerable to disturbance; the destruction of unoccupied nests during or near the nesting season could result in a significant level of take. Another example involves ground nesting species such as burrowing owls and bank swallows, which nest in cavities in the ground, making it difficult to detect whether or not their nests are occupied by eggs or nestlings or are otherwise still essential to the survival of the juvenile birds. The Service should make every effort to raise public awareness regarding the possible presence of birds and the risk of violating the MBTA, the Endangered Species Act (ESA), and the Bald and Golden Eagle Protection Act (BGEPA), and should inform the public of factors that will help minimize the likelihood that take would occur should nests be destroyed (i.e., when active nesting season normally occurs).

The Service should also take care to discern that persons who request MBTA permits for nest destruction are not targeting nests of endangered or threatened species or bald or golden eagles, so that the public can be made aware of the prohibitions of the ESA and the BGEPA against nest destruction.

In situations where it is necessary (i.e., for public safety) to remove (destroy) a nest that is occupied by eggs or nestlings or is otherwise still essential to the survival of a juvenile bird, and a permit is available pursuant to 50 CFR parts 13 and 21, the Service may issue a permit to take individual birds.

Steve Williams
Director

AVIAN REPORTING SYSTEM

USFWS Avian Mortality Reporting System

USFWS attempted in the 1970's, and again within the last few years, to estimate bird strike and electrocution mortality caused by power lines and utility structures nationwide. These estimates have been based on actual counts, extrapolations from industry, other data, and estimates based on the best information available. However, they cannot be considered conclusive, since a comprehensive nationwide study has not yet been conducted on power structures and their overall impacts on bird populations.

The former US Bureau of Sport Fisheries and Wildlife (now USFWS) published a one-time summary of bird mortality in 1979, entitled, *Human Related Mortality of Birds in the United States* (Banks 1979[1]). The report estimated annual avian mortality from varying causes between 1966 to 1972, mentioning strikes with electrical transmission wires as likely low at that time, while raising concerns about electrocutions from power transmission lines (now defined as power distribution lines) and electric fences (Banks 1979). Unfortunately, no updated mortality summary broadly encompassing hunting, scientific collecting, automobile collisions, communication tower strikes, picture window strikes, lead poisoning, electrocutions and power line strikes has been published more recently by USFWS. USFWS has published several papers on more current estimates of avian mortality, including estimates for power line strikes and electrocutions (Manville 2001a[2], 2001b[3], 2004[4]), but these publications are nowhere as comprehensive as the Banks (1979) paper. John Bridges of the Western Area Power Administration (Bridges

[1] Banks, R.C. 1979. Human related mortality of birds in the United States. U.S. Fish & Wildlife Service, National Fish and Wildlife Lab, Special Scientific Report -- Wildlife No. 215:1-16. GPO 848-972.

[2] Manville, A.M., II. 2001a. The ABCs of avoiding bird collisions at communication towers: next steps. Pp 85-103 in R.L. Carlton (editor). Avian interactions with utility and communication structures. Proceedings of a workshop held in Charleston, South Carolina, December 2-3, 1999. EPRI Technical Report, Concord, CA. 343 pp.

[3] Manville, A.M., II. 2001b. Avian mortality at communication towers: steps to alleviate a growing problem. Pp 75-86 in B.B. Levitt (editor). Cell towers -- wireless convenience? or environmental hazard? Proceedings of the "Cell Towers Forum," state of the science/state of the law, December 2, 2000, Litchfield, Connecticut. New Century Publishing 2000, Markham, Ontario. 348 pp.

[4] Manville, A.M., II. 2004. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science -- next steps toward mitigation. Bird Conservation Implementation in the Americas; Proceedings 3rd International Partners in Flight Conference 2002. C.J. Ralph and T.D. Rich, Editors USDA Forest Service GTR- PSW-191, Albany, CA 14 pp. In press.

2002 and 2003, personal communication) has provided annual summaries for avian strike mortality at a power transmission line across the Audubon National Wildlife Refuge, ND. That information, however, is site- and project-specific. The Division of Migratory Bird Management (DMBM) maintains a mortality fact sheet (prepared and periodically updated by Al Manville for public dissemination), but it is not comprehensive.

Utility Bird Mortality Tracking System

An important part of an APP is a utility's system for documenting bird mortalities and nest management activities. This system should be designed to meet the needs of the specific utility and be compatible with other data management and analysis programs. The system could utilize paper forms such as the following examples or may be an internal web-based program. The information collected should be used to help a utility conduct risk assessments by identifying avian problem areas and potential or known high risks. To protect birds and minimize outages, these data can be prioritized for corrective actions. Avian information collected by a utility should be maintained internally. Data may be required as a condition of an annual Federal permit for direct take of birds or their nests. If a Federal permit is issued, an annual report is required. The USFWS does not issue "accidental, incidental or unintentional" take permits. Bird Mortality Tracking System software developed by APLIC is available upon request for free at http://*aplic.org*.

Example 7. Dead bird/nest reporting form. This form can be used in conjunction with the Bird Mortality Tracking System software available from APLIC.

Dead Bird/Nest Form

Operations Area:

Dead Bird (circle one)		**or**	**Nest (circle one)**
Crow/magpie/raven	Eagle		Active
Hawk/falcon/osprey	Owl		Inactive
Small bird (protected)	Waterfowl		
Unknown species			

Bird Count______________

Date Found_________________________**Time Found**___________________

Sign of Death (circle one)

Collision	Electrocution	Shot	Unknown

County____

Finder's Name____

Finder's Phone____

Line Name/Circuit No.____

Pole Identification No.____

Recommended Action (circle)

Dead Bird Actions	*Nest Actions*
Cover transformer equipment	Install nest platform
Install insulator cover(s)	Relocate nest
Install triangle(s)	Trim nest
Reframe structure	Install nest guards
Replace structure	Remove nest
Remove pole	Evaluate to determine appropriate action
De-energize	No action
Install bird flight diverters/fireflies	
Evaluate to determine appropriate action (Provide action in comments)	
Continue to monitor line (Justification required)	
No action (Justification required)	

Comments____

Example 8. Southern California Edison's reporting and training materials.*

Avian Protection

Electrocutions

Raptors often perch or nest on transmission or distribution towers or poles. Occasionally, the birds make accidental contact between phases or phase and ground, injuring or electrocuting the bird. These electrocutions are most common on distribution or subtransmission facilities where energized conductors are close together. The number of electrocutions can be decreased by either designing the line to minimize contact between phases, or by retrofitting existing lines where necessary with a protective device that prevents this contact. Studies have demonstrated that raptors prefer certain poles for nesting and perching. By identifying these preferred poles, we can modify them, and thus greatly diminish the potential for raptor electrocutions in a cost-effective manner.

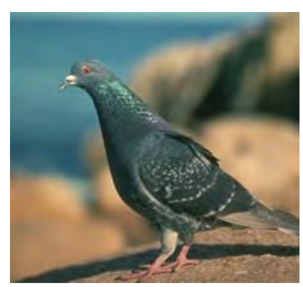
Nest Protection

In the absence of other suitable nest sites, raptors (and other protected species such as ravens) often use transmission towers and distribution poles for nesting. State and federal laws and regulations protect these nests from removal at certain times of the year without first obtaining authorization from state and federal wildlife agencies. It is important that nests not be disturbed when eggs or young birds are in them. An important note is that **there are only a few species of birds that are NOT protected by law** in SCE's service territory: **house sparrow, European starling, rock dove (common pigeon)** and certain game birds. All other species, including crows and ravens are protected by law and cannot be moved without proper authorization.

If there is a threat to power operations SCE must sometimes move an active nest (a nest with eggs or young in it). If you must move an active nest ensure environmental compliance and contact an Environmental Affairs biologist for assistance. They will make the necessary contacts with the regulatory agencies to obtain authorization for the nest to be moved.

House sparrow

European starling



Rock dove (common pigeon)

* Note: information presented in this example is specific to Southern California Edison. Contact USFWS for information on permits related to transporting eagles.

Example 8 *(con't).*

Raptor Mortality Procedures

When a dead or injured raptor is found near or on SCE equipment and facilities (e.g., poles, towers, substations) an internal report must be filed with Environmental Affairs (EA). EA will make the determination if a report to government agencies must also be filed. This is a step-by-step guide to help in the process of completing the raptor mortality report.

Both bald and golden eagles occur within SCE's service territory. Though rare, eagle electrocutions do occur on our lines, especially golden eagles. When an eagle is electrocuted, EA must be contacted immediately and special arrangements must be made for transport of the bird. It is illegal to transport eagles in the U.S. **DO NOT transport any eagle unless authorized by EA**.

1. Identify the species of raptor.
Identify the species if possible, especially to determine whether the raptor is an eagle or other raptor. Adult bald and golden eagles range anywhere from 30" to 40" in length and have a 72" to 84" wingspan while other raptors, such as red-tailed hawks are considerably smaller at about 19" in length and a 48" to 56" wingspan. See the attached guide. Whenever there is a doubt, contact Environmental Affairs (EA) for guidance. Take pictures (digital preferred) and send to EA so we can identify the bird.

If the bird is an eagle, follow the instructions directly below. For all other species, go directly to Step Number 2.

<u>Eagle electrocutions:</u>
Call or page EA immediately. You will be given guidance on the next course of action to take. It is illegal to transport eagles in the U.S. Do NOT transport an eagle unless authorized by EA. If the incident occurs after business hours, have the Edison operator connect you with EA staff.

All structures where an eagle electrocution has occurred must be corrected right away. Please contact EA for assistance in making these corrections to the structures.

After contacting EA and following the instructions given, continue to number 2.

2. Fill out a Raptor Mortality Report.
This form is available through EA or can be found on the Environmental Affairs website on SCE's Intranet. Fill out the report as completely as possible. Include maps of the area and, if possible, pictures of the structure, the bird, and the surrounding area (so we have an idea of the habitat in the vicinity of the pole.) Submit this report to EA as soon as possible after the incident.

Whenever multiple electrocutions occur within a few span lengths or on the same structure, these structures should be made raptor safe as soon as possible. Please contact EA for assistance in making these corrections to the structures.
Species other than eagles can be buried on site (away from the pole). You should have a current copy of SCE's U.S. Fish & Wildlife Permit in your vehicle in order to do this legally.

This permit requires us to maintain records of electrocutions. If you do not have a copy of this document, please contact EA.

3. Send the completed form and attachments to EA.
Send the completed form and any pictures to:
Tracey Alsobrook, Environmental Affairs, G.O. 1

Remember, ordinary people and agencies are watching our activities. We must comply with the laws that protect almost all birds in the U.S. Report all known mortalities to EA. We need your assistance to keep the Company in compliance with the laws and in protecting these natural resources.

Call us when you need help with raptor mortality procedures or raptor protection.

	PAX		PAX
Daniel C. Pearson	29562	Janet Baas	29541
Tracey Alsobrook	27547	Jill Fariss	28545

Golden Eagle

Eagles:
(e.g., golden & bald eagles)
Length: 30-40”
Wingspan: 6½ to 7 feet

Red-Tailed Hawk

Hawks:
(e.g., red-tailed & red-shouldered hawks)
Length: 15-23”
Wingspan: 4 to 4½ feet

Great-horned Owl

Owls:
(e.g., great-horned, barn & great gray owls)
Length: 16-27”
Wingspan: 3½ to 4 ½ feet

Golden Eagle Silhouette

General Hawk Silhouette

Example 8 *(con't).*

Animal/Bird Mortality Report

To: Tracey Alsobrook
Environmental Affairs (EA)
GO1, Quad 1A

Date: ________________________

From: Name ____
Work Location___________________________ PAX ______________

Describe the species of the Animal or Bird that was mortally injured by SCE facilities (electrocuted/hit by a SCE vehicle, etc.).

____
____

If any bands or tags please return to EA or write number and agency here

____
____

Describe how the Animal or Bird was mortally injured by SCE facilities (bird contacted transformer bushings, etc.).

____
____
____
____

Weather Conditions (e.g. rainy and cold, sunny and warm, etc.)

____
____
____

Circuit Name & Voltage____

Specific Problem Location (e.g. Pole #/Address/Cross Streets, etc.)

____
____
____

Description of Terrain and Vegetation in Area (e.g. near agriculture area, dense city area, residential housing, etc.)

____
____
____

Please attach picture of the Bird or Animal if possible.

***Example8** (con't).*

Raptor/Bird Nesting Record

To: Tracey Alsobrook
Environmental Affairs
GO1, Quad 1A

Date: ________________________

From: Name ____
Work Location___________________________ PAX _____________

Species of Raptor/Bird (if known) ___________________________

Circuit Name and Voltage __________________________________

Specific Nest Location (pole no.) ___________________________

Condition of Nest

____
____

Are Eggs or Young Birds Apparent? If so, please describe.

____
____
____

Description of Terrain and Vegetation in Area (e.g. near agriculture area, dense city area, residential housing, etc.)

____
____
____

History of Previous Nesting on This Circuit

____
____
____

History of Electrocutions/Mortality on This Circuit

____
____
____

Recommendations

____
____
____

Please attach picture of the Bird and/or Nest, if possible.

RISK ASSESSMENT METHODOLOGY

Thousands of utility poles occur in areas of suitable habitat for migratory birds. Because remedial actions on all poles in such areas are neither economically justifiable nor biologically necessary, a method is needed to identify configurations or locations of greatest risk. Risk assessment studies and models can be implemented to more effectively allocate resources to protect migratory birds. While risk assessment procedures will vary among utilities based on geographic scale, available data, and funding resources, included below are examples of risk assessment methods employed by different utilities.

Example 9. Risk Assessment Methodology Employed by PacifiCorp.

Reactive, preventative, and proactive measures can be adopted to minimize avian electrocutions. Reactive measures can be conducted at a structure after a mortality has occurred; preventative measures can be taken by constructing new structures to avian-safe standards in avian use areas; proactive measures can incorporate protocols to assess electrocution risk in an effort to prevent avian mortality on existing structures. Such risk assessment procedures can be useful aids when deciding where to allocate limited dollars over large geographic areas. The risk assessment methodology described in this example is based upon field surveys of poles, however, similar procedures could be followed using comparable GIS (Geographic Information System) data.

Based on a need to identify and quantify raptor electrocution risks throughout its service area, PacifiCorp implemented a program to assess electrocution risk, develop a scoring system to prioritize structures and circuits for remedial action, and create a GIS to assist in managing and analyzing spatial information regarding line locations, pole configurations, electrocutions, outages, and raptor distributions. Trained observers, while walking rights-of-way, recorded data on structure configuration, evidence of avian activity, and presence of dead birds. They searched an area encompassing 15 ft. on each side of the central line and a 25-ft. radius around each pole for carcasses, prey remains, pellets, and whitewash. At each pole, data were recorded on the pole location, habitat type, pole configuration, avian mortalities, live species observed, evidence of raptor use, and presence of avian nests (see Example 10 for data sheet). In addition, the surveyor assessed whether or not each structure was avian-safe (based on current *Suggested Practices* standards).

Existing GIS data layers containing information on habitat type and raptor nest locations were compiled. State wildlife resource agencies, Natural Heritage Programs, universities, USFWS, Bureau of Land Management, U.S. Forest Service, and U.S. Geological Survey may serve as clearinghouses for such data. Pole locations and configurations, raptor nest site locations, habitat, and other field survey data were compiled and analyzed in ArcView GIS.

To assess the risk of electrocution, each non-avian-safe structure was assigned a score based on abundance (>50% total area) of suitable raptor habitat within a 1-km radius, evidence of raptor use, presence of raptor nests within 1 km, and presence of avian mortalities. Structures were assigned one point each for presence of suitable habitat, raptor nests, or evidence of raptor use. Structures at which non-eagle avian mortalities were documented were assigned four points. Structures with eagle mortalities were assigned five points. All scores of five or greater were lumped together in a "very high risk" category.

Using the above scoring method, non-avian-safe poles were assigned the following risk assessment scores:

Score	**Risk Assessment**
0	N/A
1	LOW RISK
2	LOW/MODERATE RISK
3	MODERATE RISK
4	HIGH RISK
5+	VERY HIGH RISK

These risk assessment scores are then used to target remedial actions. While structures with mortalities (risk scores ≥4) receive immediate attention, structures or circuits without mortalities are prioritized for ongoing remedial efforts based on their relative risk and circuit reliability. In addition to selecting poles that pose a moderate risk, other structures are selected for remedial actions based on a "common sense" review of the data. This "common sense" review applies additional data layers (i.e. outages and historical mortalities) and best

Example 9 *(con't).*

Example 9 *(con't).*

professional judgment to identify structures that warrant proactive remedial action. Below is a list of criteria that may elevate the risk scores of structures:

- Poles adjacent to mortality poles
- Poles near mortality poles with a similar configuration
- Circuits, lines, or taps where multiple mortalities have occurred
- Deadend equipment poles in remote or rural areas
- Configurations that have been documented to have a heightened risk in a particular district
- Non-raptor-safe poles in otherwise raptor-safe lines
- Non-raptor-safe poles adjacent to poles with perch discouragers
- Incomplete or improper installation of existing avian protection devices
- Circuits or lines with a history of bird-caused or unknown-cause outages
- Poles that pose other safety or reliability risks

Once all poles are identified, a comprehensive remedial action plan is developed with the appropriate service district that identifies a course of action, timeline, and resources required. The location and number of poles retrofitted, and associated costs are documented. Future monitoring is conducted to document the effectiveness of these efforts and to identify other areas that may require action. In addition, this methodology can be used to research electrocution risks associated with particular configurations or species. This risk assessment database is updated and refined as new information becomes available. For additional information on this risk assessment methodology, contact Jim Burruss (jim.burruss.@pacificorp.com) or Sherry Liguori (sherry.liguori@pacificorp.com).

Example 10. PacifiCorp's Risk Assessment Data Sheet.

Avian Electrocution Risk Assessment
Data Sheet

Date ____________________

Observer(s) ____________________

Sheet _______ **of** _________

IF A MORTALITY WAS DOCUMENTED, CHECK HERE ______

Operations Area ____________________ **Circuit** ____________________ **Line** ______________

HABITAT TYPE (Circle. If more than one apply, indicate percent of each.)

Grassland/ meadow Cropland/Pasture Scrub/shrub Barren Riparian Residential/developed Deciduous forest Coniferous forest

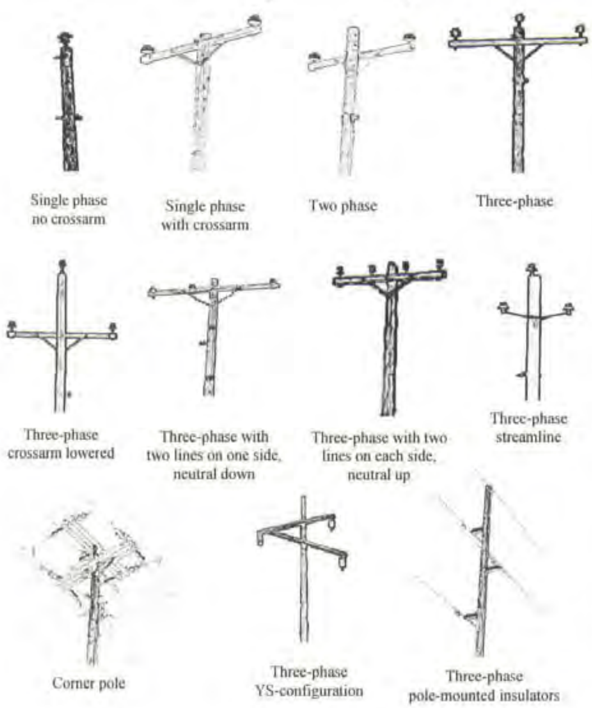
Wet meadow Mudflat Open water Other: ____________________

POLE LOCATION/IDENTIFICATION:

Structure Identification Number ____________________

GPS Coordinates: ____________________ Coordinate System: ______________ Units: meters feet

POLE CONFIGURATION (Circle one. If pole does not match any shown, draw it on other side of sheet.)



Is structure raptor safe? Yes No

Total no. energized conductors ____________

(if corner pole or underbuilt, indicate number phases in each direction, i.e. 3-3 or 3-2-1)

Number of transformers ____________

Are there exposed parts? (circle all that apply)

transformers, capacitors, cutouts, arresters, jumper wires

Crossarm material: wood metal fiberglass

Crossarm brace material: wood metal fiberglass

Location of ground wire:

Below crossarm At or above crossarm

Circle all that are present: Hose Bushing cap

Arrester cap Cutout cover Insulator cover

Perch guard Perch Down-guy insulator

Other protective devices: ______________

Circle if present: Pellets Whitewash Prey remains

Are there live raptors, mortalities, nests, or pole damage? No Yes* (*if yes, continue on other side)

Example 10 *(con't).*

POLE CONDITION (Circle all that apply)

Broken insulator   Broken crossarm   Leaking transformer   Broken/burned/leaning pole   Broken guywire

Other: ____________________

MORTALITIES/INJURIES

Status: dead injured   **Number individuals** ______   **Distance to nearest pole (ft.)**______

Species (circle one): Red-tailed Hawk   Ferruginous Hawk   Swainson's Hawk   Broad-winged Hawk   Harris's Hawk   Red-shouldered Hawk   Rough-legged Hawk   Golden Eagle   Bald Eagle   Osprey   Peregrine Falcon   Prairie Falcon   Merlin   American Kestrel   Great Horned Owl   Barn Owl   Common Raven   American Crow   Great Blue Heron

Other: ____________________

Cause of death/injury: Unknown   Electrocution   Collision   Shot   Roadkill   Other: ______

Evidence of electrocution: Burnt feathers   Burnt talons   Burnt bill   Exit wound   Other: ______

Status of carcass/remains: Buried   Collected   Left on-site   **Band number** (if applicable) ______

Directions____________________

Photo number______________ **Camera number**______________

Recommended remedial action____________________

____

LIVE SPECIES OBSERVED

Species __________ **Number of individuals** ____ **Behavior** __________

Species __________ **Number of individuals** ____ **Behavior** __________

Species __________ **Number of individuals** ____ **Behavior** __________

Nest?______ **Species**__________ **Is nest active?** Yes No

Nest location: Tree   Cliff   Ground   Utility pole   Other: __________

Pole Diagram:

NOTES____________________

____

____

____

Record Tracking:

USFWS Notification______________ Date______

Bird Mortality Tracking System Entry______________ Date______

Remedial Action Status______________ Date______

MORTALITY REDUCTION MEASURES

A utility can have the greatest impact on reducing avian mortality by focusing its efforts in a cost-effective manner on the areas that pose the greatest risk to migratory birds. Therefore, as a general matter, mortality reduction plans should include a method for evaluating the risks posed to migratory birds in a manner that identifies areas and issues of particular concern. A risk assessment will often begin with an evaluation of available data addressing areas of high avian use, avian mortality, nesting problems, established flyways, adjacent wetlands, prey populations, perch availability, and other factors that can increase avian interactions with utility facilities. The assessment may also include outage and circuit reliability information. Mortality reduction plans should also utilize biological and electrical design information to prioritize poles most in need of repair and identify causes of avian mortality and benefits to utility customers. A successful APP and mortality reduction plan require management support as well as the following:

- assessment of facilities to identify risks;
- allocation of resources;
- standards for new or retrofit construction;
- budget for Operation and Maintenance (O&M) and Capital fixes;
- system for tracking remedial actions and associated costs;
- timely implementation of remedial measures;
- positive working relationship with agencies.

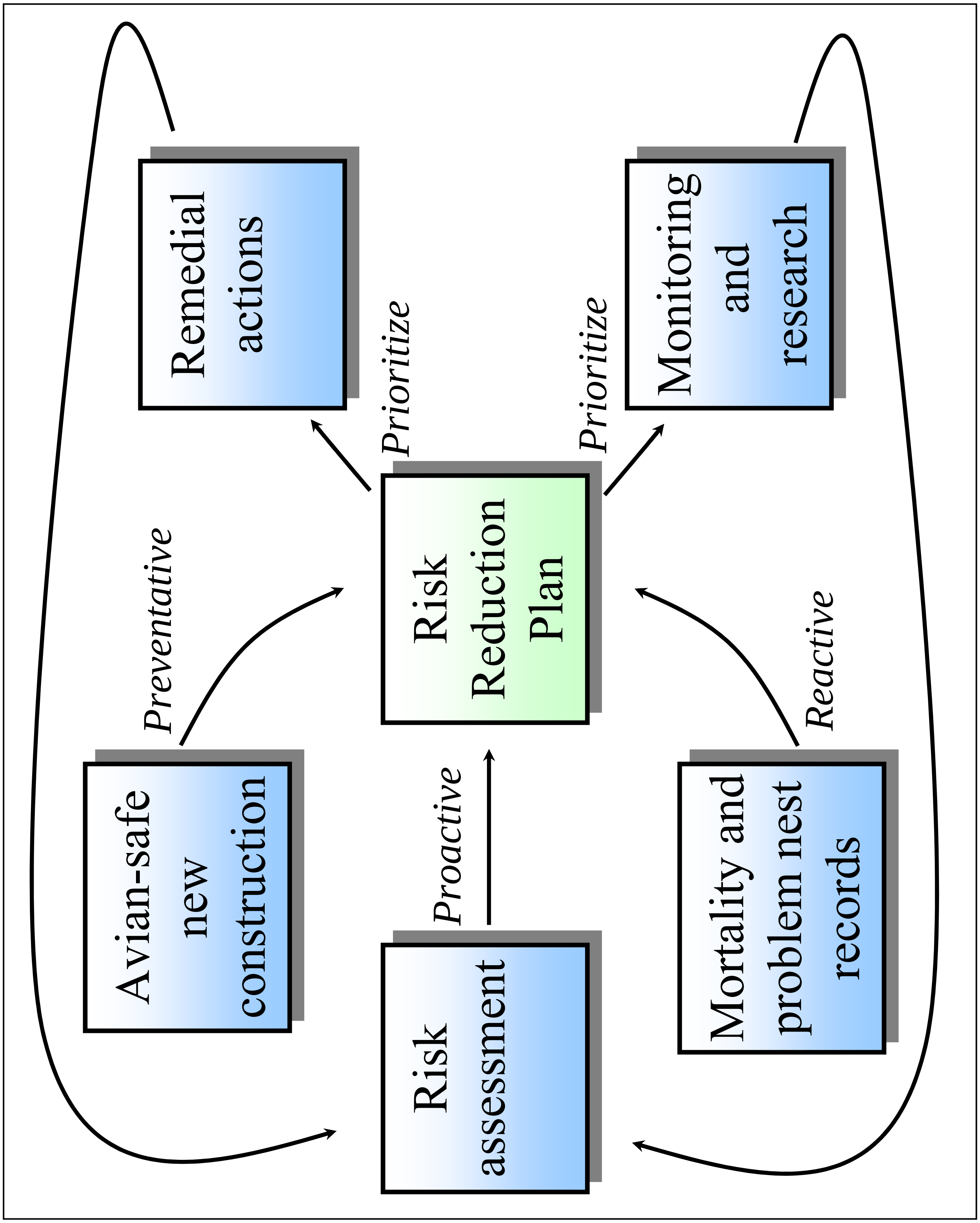
Mortality reduction plans may include a strategy that incorporates preventative, reactive and proactive measures that focus on issues, risks, and reliability commitments facing a utility (Figure 13). An example of how this multi-faceted approach might be used is as follows:

- **Preventative**: Construct all new or rebuilt lines in high avian use areas to Company avian-safe standards. Ensure APP is in compliance with applicable laws, regulations and permits.

- **Reactive**: Document bird mortalities and problem nests; conduct assessment of problems and apply remedial measures where appropriate. Notify resource agencies in accordance with Company's permits and policy.
- **Proactive**: Provide resources and training to improve employee's knowledge and awareness. Partner with organizations that conduct research on effects of bird interactions with power lines. Evaluate electrocution and collision risks of existing lines in high avian use areas and modify structures where appropriate.
- **Collaborative**: Collaboration with USFWS and State agencies on electrocutions reported and remedial actions undertaken. Annually review the APP in the context of risk assessment and electrocution and collision incidents and modify as appropriate, ideally with agency input.

Modification of existing facilities may be deemed necessary when dead and/or injured birds are found, high-risk lines are identified, or concerns of legal compliance are at issue. "Problem poles" or high-risk lines may be identified through bird mortality records, field surveys, or notifications from agency representatives or concerned customers. System reliability concerns due to bird interactions may also result in requests from field operations staff. Retrofitting to prevent electrocutions could include: 1) covering jumper wires, conductors and equipment; 2) discouraging perching in unsafe areas; 3) reframing; or 4) replacing a structure. Retrofitting to prevent collisions may include: 1) installing markers to enhance the visibility of lines; 2) managing habitats to reduce the likelihood of birds crossing lines during daily flights; or 3) managing human activity near collision risk areas to prevent flushing. Implementing preventative, reactive, and proactive measures to reduce avian mortality can benefit a utility through reduced long-term costs, improved reliability, positive public and agency relations, and conservation of migratory birds.

Figure 13. Roles of preventative, proactive, and reactive measures in a mortality risk reduction plan.



AVIAN ENHANCEMENT OPTIONS

While an APP will include measures to reduce avian mortality associated with electrical operations, it can also include opportunities to enhance avian populations through the creation of nest platforms, habitat improvements for migratory birds, or cooperative efforts with agencies or organizations. USFWS and State wildlife resources agencies, as well as other experts, can be consulted for recommendations on habitat enhancement projects. Nest platforms can be erected on poles for birds such as osprey, eagles, hawks, owls, herons, and cormorants, etc. (Figure 14). In addition, nest boxes can be erected for cavity-nesting species such as bluebirds, swallows, chickadees, wrens, and others. Such boxes may also benefit bats and flying squirrels. Construction designs for bird boxes can be found at http://50birds.com. Commercially-made nest boxes and platforms may also be available from local nature centers or specialty stores. The construction, maintenance, and monitoring of nest boxes can be done in conjunction with volunteers, such as scouts, or avian conservation organizations (see Key Resources for a list of bird conservation organizations/centers). Such collaborative efforts are excellent opportunities to educate the public about the company's avian protection plan and its partnerships with wildlife conservation agencies and organizations.

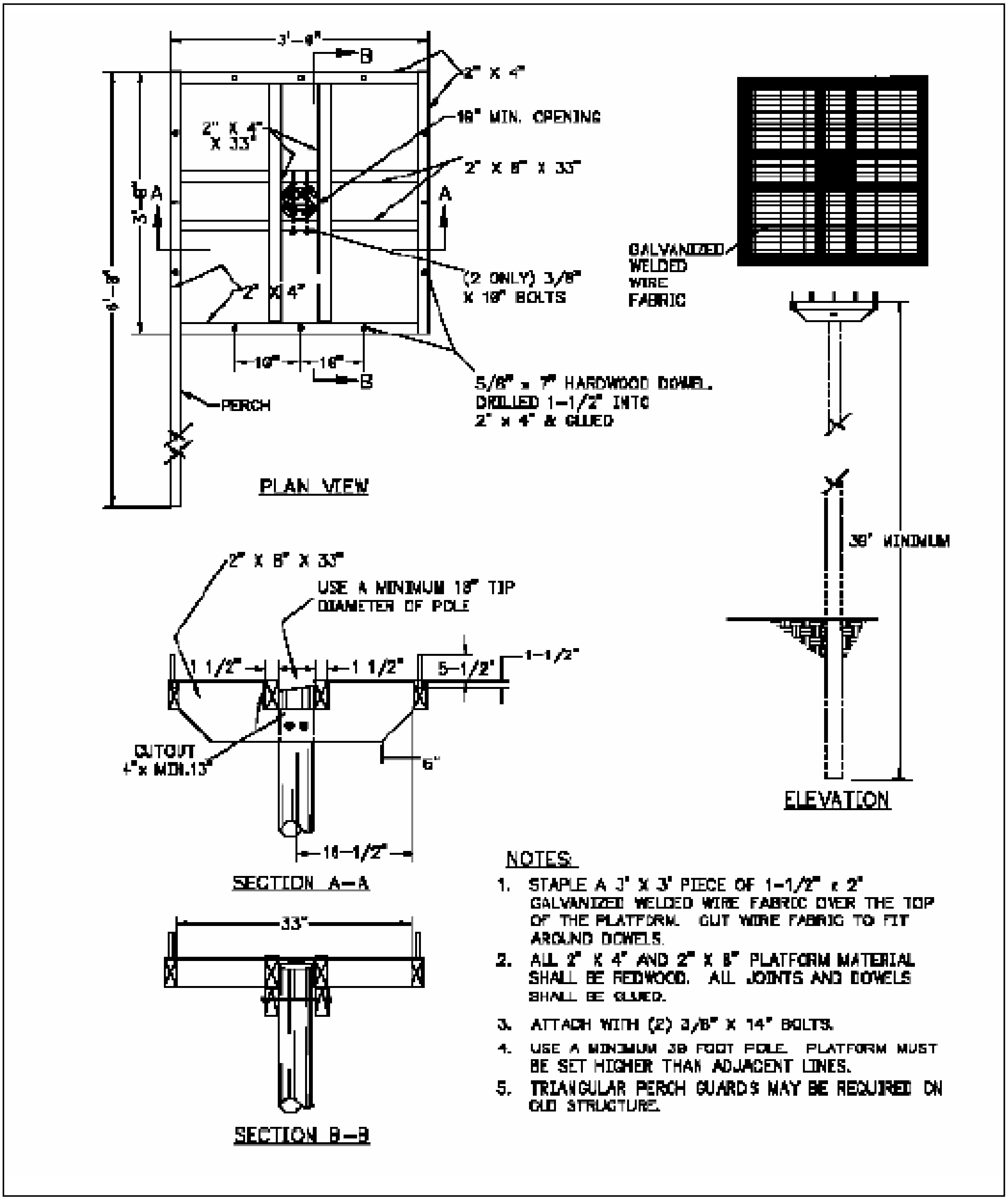


Figure 14. Raptor nest platform, pole mounted.

QUALITY CONTROL

A quality control mechanism can and should be incorporated into an APP to evaluate the effectiveness of a company's avian protection procedures. Some examples of quality control assessments include:

- assessing remedial action techniques through follow-up surveys to evaluate their effectiveness in reducing avian mortality;
- assessing avian protection devices to identify products preferred for avian protection as well as ease of application and durability;
- assessing mortality reporting procedures to ensure that discoveries of avian mortalities are properly documented;
- assessing response to avian mortalities to ensure that appropriate actions are taken in a timely manner;
- assessing compliance with company procedures to ensure that personnel are consistently following company methods for avian-safe construction, mortality reporting, nest management, etc.;
- assessing public and agency opinions on system reliability and avian protection.

The quality control component of an APP is an ongoing process. Information gathered during assessments of existing practices should be used to improve the effectiveness and timeliness of avian protection efforts, which, in turn, can help to reduce costs associated with such efforts.

PUBLIC AWARENESS

A public awareness program can be an integral part of an APP. This program can be used to enhance general public awareness and support for an electric utility's APP. It allows stakeholders such as government agencies, Tribes, non-profit organizations, wildlife rehabilitators and other interested parties an opportunity to provide input to the decision-making process, enabling all parties to work openly and collaboratively towards recommendations that can be effectively implemented. This collaboration often leads to improved relationships within the community and to more efficient and positive projects. The relationships developed through this process may also encourage the public to report bird mortalities and encourage them to seek assistance for birds that have been injured in power line related accidents.

Effectively communicating the components involved in an APP can be done through a variety of public outreach tools including fact sheets, newsletters, brochures, videos, websites and speaker bureau presentations. These tools can also be used to record the successes of an APP, thereby documenting the utility and electric industry's efforts to reduce avian mortalities. The goal of these outreach efforts is to convey to the public that electric utilities are responsible stewards of the environment working cooperatively with wildlife agencies towards reducing avian mortalities while continuing to provide safe, reliable, affordable electricity to their customers.

Many utilities have specific examples of their environmental stewardship and innovative ways they have taken into consideration reducing environmental impacts in their business decisions. A company’s cooperative and innovative efforts to minimize avian mortalities should be shared with the public and resource agencies.

KEY RESOURCES

U.S. Fish and Wildlife Service Migratory Bird Permit Regional Offices

Region 1: (California, Hawaii, Idaho, Nevada, Oregon, Washington, Guam, CNMI, American Samoa)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
911 N.E. 11th Avenue
Portland, OR 97232-4181
Tel. (503) 872-2715. Fax (503) 231-2019.
Email: permitsR1MB@fws.gov

Region 2: (Arizona, New Mexico, Oklahoma, Texas)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
P.O. Box 709
Albuquerque, NM 87103
Tel. (505) 248-7882. Fax (505) 248-7885.
Email: permitsR2MB@fws.gov

Region 3: (Iowa, Illinois, Indiana, Minnesota, Missouri, Michigan, Ohio, Wisconsin)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
One Federal Drive
Fort Snelling, MN 55111
Tel. (612) 713-5436. Fax (612) 713-5393
Email: permitsR3MB@fws.gov

Region 4: (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virgin Islands, Puerto Rico)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
P.O. Box 49208
Atlanta, GA 30359
Tel. (404) 679-7070. Fax (404) 679-4180
Email: permitsR4MB@fws.gov

Region 5: (Connecticut, District of Columbia, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, West Virginia)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
P.O. Box 779
Hadley, MA 01035-0779
Tel. (413) 253-8643. Fax (413) 253-8424
Email: permitsR5MB@fws.gov

Region 6: (Colorado, Kansas, Montana, North Dakota, Nebraska, South Dakota, Utah, Wyoming)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
P.O. Box 25486 DFC (60154)
Denver, CO 80225-0486
Tel. (303) 236-8171. Fax (303) 236-8017
Email: permitsR6MB@fws.gov

Region 7: (Alaska)
U.S. Fish and Wildlife Service Migratory Bird Permit Office
1011 E. Tudor Road
Anchorage, AK 99503
Tel. (907) 786-3693. Fax (907) 786-3641
Email permits: R7MB@fws.gov

U.S. Fish and Wildlife Service Office of Law Enforcement

National Headquarters:
Office of Law Enforcement
U. S. Fish and Wildlife Service
4401 North Fairfax Drive,
MS-LE-3000
Arlington, Virginia, USA 22203
Telephone: 703-358-1949
Fax: 703-358-2271

Regional Offices:

Pacific Region (1): California, Hawaii, Idaho, Nevada, Oregon, Washington, Guam, CNMI, American Samoa)
U. S. Fish & Wildlife Service
Office of Law Enforcement
911 N. E. 11th Avenue
Portland, Oregon, USA 97232-4171
Phone: (503) 231-6125 Fax: (503) 231-6197

Southwest Region (2): Arizona, New Mexico, Oklahoma, Texas
U. S. Fish & Wildlife Service
Office of Law Enforcement
P.O. Box 329
Albuquerque, New Mexico, USA 87103
Phone: (505) 248-7889 Fax: (505) 248-7899

Great Lakes - Big Rivers Region (3): Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin
U. S. Fish & Wildlife Service
Office of Law Enforcement
One Federal Drive
Fort Snelling, Minnesota, USA 55111-0045
Phone: (612) 713-5320 Fax: (612) 713-5283

Southeast Region (4): Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico and the Virgin Islands
U. S. Fish & Wildlife Service
Office of Law Enforcement
P.O. Box 49226
Atlanta, Georgia, USA 30359
Phone: (404) 679-7057 Fax: (404) 679-7065

Northeast Region (5): Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia,
U. S. Fish & Wildlife Service
Office of Law Enforcement
300 Westgate Center Drive
Hadley, Massachusetts, USA 01035
Phone: (413) 253-8274 Fax: (413) 253-8459

Mountain-Prairie Region (6): Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, Wyoming
U. S. Fish & Wildlife Service
Office of Law Enforcement
P.O. Box 25486 - DFC
Denver, Colorado, USA 80225
Phone: (303) 236-7540 Fax: (303) 236-7901

Alaska Region (7): Alaska
U. S. Fish & Wildlife Service
Office of Law Enforcement
1011 E. Tudor Road, Mail Stop 151
Anchorage, Alaska, USA 99503-6199
Phone: (907)786-3311 Fax: (907)786-3313

Other Resource Agency Contacts

BLM Snake River Birds of Prey National Conservation Area

- The Snake River Birds of Prey NCA is home to the largest concentration of nesting raptors in North America.
- http://id.blm.gov/bopnca/index.html

Canadian Wildlife Service

- http://cws-scf.ec.gc.ca/index_e.cfm

Code of Federal Regulations (CFR) websites

- Main CFR webpage
    - http://gpoaccess.gov/cfr/
- List of migratory birds, 50CFR10.13
    - http://a257.g.akamaitech.net/7/257/2422/01dec20031500/edocket.access.gpo.gov/cfr_2003/octqtr/50cfr10.13.htm
- General permit procedures, 50CFR13
    - http://access.gpo.gov/nara/cfr/waisidx_03/50cfr13_03.html
- Endangered and threatened wildlife and plants, 50CFR17
    - http://access.gpo.gov/nara/cfr/waisidx_03/50cfrv2_03.html
- Migratory bird permits, 50CFR21
    - http://access.gpo.gov/nara/cfr/waisidx_03/50cfr21_03.html
- Eagle permits, 50CFR22
    - http://access.gpo.gov/nara/cfr/waisidx_03/50cfr22_03.html

International Association of Fish and Wildlife Agencies

- The International Association of Fish and Wildlife Agencies (IAFWA) was founded in 1902 as a quasi-governmental organization of public agencies charged with the protection and management of North America's fish and wildlife resources. The Association has been a key organization in promoting sound resource management and strengthening federal, state, and private cooperation in protecting and managing fish and wildlife and their habitats in the public interest. The Association's governmental members include the fish and wildlife agencies of the states, provinces, and federal governments of the U.S. and Canada. All 50 states are members.
- http://iafwa.org

National Biological Information Infrastructure

- The National Biological Information Infrastructure (NBII) is a broad, collaborative program to provide increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry. NBII partners and collaborators also work on new standards, tools, and technologies that make it easier to find,

integrate, and apply biological resources information. Resource managers, scientists, educators, and the general public use the NBII to answer a wide range of questions related to the management, use, or conservation of this nation's biological resources.
- http://birdcon.nbii.gov

NOAA Photo Library
- Public domain images for download
- http://photolib.noaa.gov/index.html

U.S. Fish and Wildlife Service
- http://fws.gov

U.S. Fish and Wildlife Service National Eagle Repository
- http://mountain-prairie.fws.gov/law/eagle
  U. S. Fish and Wildlife Service
  National Eagle Repository
  Rocky Mountain Arsenal, Building 619
  Commerce City, Colorado 80022
  phone: (303) 287-2110
  fax: (303) 287-1570

U.S. Fish and Wildlife Service National Image Library
- Public domain images for download
- http://images.fws.gov

USGS Bird Banding Laboratory
- http://pwrc.usgs.gov/bbl/

USGS Patuxent Bird Identification InfoCenter
- Presents photographs, songs, videos, identification tips, maps, and life history information for North American birds.
- http://mbr-pwrc.usgs.gov/id/framlst/framlst.html

USGS Patuxent Wildlife Research Center
- Patuxent's mission is to excel in wildlife and natural resource science, providing the information needed to better manage the nation's biological resources
- http://pwrc.usgs.gov

USGS Raptor Information System
- The Raptor Information System (RIS) is a computerized literature retrieval system. It deals with raptor management, human impacts on raptors, the mitigation of adverse impacts, and basic raptor biology (with an emphasis on population dynamics and predation). The RIS may be the largest collection of literature on birds of prey found anywhere in the world, with approximately

30,000 references on raptor biology and management. RIS staff members regularly update the files and accompanying data base with recently published and/or newly acquired references on raptors. The collection includes reprints of published papers as well as a significant amount of "gray literature" in the form of popular articles, theses, dissertations, unpublished government reports, and progress reports.
http://ris.wr.usgs.gov

State Agencies

Alabama Division of Wildlife and Freshwater Fisheries
- http://dcnr.state.al.us/agfd/index.html

Alaska Department of Fish and Game
- http://adfg.state.ak.us

Arkansas Game and Fish Commission
- http://agfc.com

Arizona Game and Fish Department
- http://gf.state.az.us

California Department of Fish and Game
- http://dfg.ca.gov

Colorado Division of Wildlife
- http://wildlife.state.co.us

Connecticut Bureau of National Resources, Wildlife Division
- http://dep.state.ct.us/burnatr/wildlife/wdhome.htm

Delaware Division of Fish and Wildlife
- http://dnrec.state.de.us/fw

Florida Fish and Wildlife Conservation Commission
- http://floridaconservation.org

Georgia Division of Wildlife Resources
- http://georgiawildlife.dnr.state.ga.us

Hawaii Department of Land and Natural Resources
- http://state.hi.us/dlnr

Iowa Department of Natural Resources
- http://iowadnr.com

Idaho Fish and Game
- http://state.id.us/fishgame

Illinois Department of Natural Resources
- http://dnr.state.il.us

Indiana Department of Natural Resources
- http://in.gov/dnr

Kansas Department of Wildlife and Parks
- http://kdwp.state.ks.us

Kentucky Department of Fish and Wildlife
- http://kdfwr.state.ky.us

Louisiana Department of Wildlife and Fisheries
- http://wlf.state.la.us/apps/netgear/page1.asp

Massachusetts Division of Fisheries and Wildlife
- http://state.ma.us/dfwele/dfw/dfw_toc.htm

Maryland Department of Natural Resources
- http://dnr.state.md.us

Maine Department of Inland Fisheries and Wildlife
- http://state.me.us/ifw

Michigan Department of Natural Resources
- http://michigan.gov/dnr

Minnesota Department of Natural Resources
- http://dnr.state.mn.us/index.html

Missouri Department of Conservation
- http://conservation.state.mo.us

Mississippi Department of Wildlife, Fisheries and Parks
- http://mdwfp.com

Montana Department of Fish, Wildlife and Parks
- http://fwp.state.mt.us

Nebraska Game and Parks Commission
- http://ngpc.state.ne.us/homepage.html

Nevada Department of Wildlife
- http://ndow.org

New Hampshire Fish and Game Department
- http://wildlife.state.nh.us

New Jersey Division of Fish and Wildlife
- http://state.nj.us/dep/fgw

New Mexico Game and Fish Department
- http://gmfsh.state.nm.us

New York Division of Fish, Wildlife and Marine Resources
- http://dec.state.ny.us/website/dfwmr/index.html

North Carolina Wildlife Resources
- http://ncwildlife.org

North Dakota Game and Fish Department
- http://state.nd.us/gnf

Ohio Division of Wildlife
- http://ohiodnr.com/wildlife/default.htm

Oklahoma Department of Wildlife Conservation
- http://wildlifedepartment.com

Oregon Department of Fish and Wildlife
- http://dfw.state.or.us

Pennsylvania Fish and Boat Commission
- http://pgc.state.pa.us

Rhode Island Division of Fish and Wildlife
- http://state.ri.us/dem/programs/bnatres/fishwild/index.htm

South Carolina Department of Natural Resources
- http://water.dnr.state.sc.us

South Dakota Department of Game, Fish and Parks
- http://state.sd.us/gfp

Tennessee Wildlife Resources Agency
- http://state.tn.us/twra/index.html

Texas Parks and Wildlife Department
- http://tpwd.state.tx.us

Utah Division of Wildlife Resources

- http://wildlife.utah.gov

Virginia Department of Game and Inland Fisheries

- http://dgif.state.va.us

Vermont Department of Fish and Wildlife

- http://vtfishandwildlife.com

Washington Department of Fish and Wildlife

- http://wdfw.wa.gov

Wisconsin Department of Natural Resources

- http://dnr.state.wi.us

West Virginia Division of Natural Resources

- http://wvdnr.gov

Wyoming Game and Fish Department

- http://gf.state.wy.us

Bird Conservation Organizations/Centers/Resources

(Includes organization's mission statement/description followed by website)

Alaska Bird Observatory

- The Alaska Bird Observatory is an Alaska nonprofit corporation. The mission of ABO is to advance the appreciation, understanding, and conservation of birds and their habitats through research and education.
- http://alaskabird.org

American Bird Conservancy

- American Bird Conservancy (ABC) is a 501(c)3 not-for-profit organization, whose mission is to conserve wild birds and their habitats throughout the Americas. It is the only U.S.-based, group dedicated solely to overcoming the greatest threats facing birds in the Western Hemisphere.
- http://abcbirds.org

Cornell Lab of Ornithology

- The Lab is a nonprofit membership institution whose mission is to interpret and conserve the earth's biological diversity through research, education, and citizen science focused on birds. Our programs work with citizen scientists, government and nongovernment agencies across North America and beyond.
- http://birds.cornell.edu

50 Birds

- Wood bird house designs for more than 50 North American birds
- http://50birds.com/Default.htm

Gulf Coast Bird Observatory

- The mission of the Gulf Coast Bird Observatory is the study and conservation of birds and their habitat in and around the Gulf of Mexico. Our purpose is to be a catalyst for bird conservation through individual and community partnerships and the sharing of expertise and knowledge.
- http://gcbo.org

Hawk Mountain Sanctuary Association

- Hawk Mountain's mission is to foster the conservation of birds of prey worldwide and to create a better understanding of, and further the conservation of, the natural environment, particularly the Central Appalachian region.
- http://hawkmountain.org

Hawks Aloft, Inc.

- Hawks Aloft, Inc. (HAI) was founded in February of 1994 in Albuquerque, New Mexico. Our mission is to conserve indigenous wild birds and their habitats through research and public education. HAI projects take place almost entirely within the state of New Mexico. We have become a leader in providing quality

education programs and field research. Using live raptors as educational aids, our naturalists reach more than 30,000 students annually. Our long-term research projects monitor raptor and songbird populations, as they relate to land management practices.
- http://hawksaloft.org

HawkWatch International
- Mission: To monitor and protect hawks, eagles, and other birds of prey and their environment through research, education, and conservation.
- http://hawkwatch.org

Idaho Bird Observatory
- IBO's Mission: To contribute to the conservation of western migratory birds and their habitats through cooperative research and public education.
- http://boisestate.edu/biology/ibo

Klamath Bird Observatory
- A nonprofit research and educational organization
- http://klamathbird.org/kbohome.htlm

Massachusetts Audubon Society
- Massachusetts Audubon Society is the largest conservation organization in New England, concentrating its efforts on protecting the nature of Massachusetts for people and wildlife. Mass Audubon protects more than 30,000 acres of conservation land, conducts educational programs for 250,000 children and adults annually, and advocates for sound environmental policies at the local, state, and federal levels. Established in 1896 and supported by 68,000 member households, Mass Audubon maintains 42 wildlife sanctuaries that are open to the public and serve as the base for its conservation, education, and advocacy work across the state.
- http://massaudubon.org

Montana Raptor Conservation Center
- Mission: Montana Raptor Conservation Center was founded in response to the rapid development of southwest Montana and resulting negative conflicts between humans and birds of prey. Through education, habitat enhancement, research, and the rehabilitation and release of injured birds of prey, our mission is to conserve and restore raptors, as well as other avian species that are endangered, threatened or of special concern.
- http://montanaraptor.org

National Audubon Society
- Audubon's mission is to conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats for the benefit of humanity and the earth's biological diversity.

- http://audubon.org

National Fish and Wildlife Foundation

- The National Fish and Wildlife Foundation conserves healthy populations of fish, wildlife and plants, on land and in the sea, through creative and respectful partnerships, sustainable solutions, and better education. The Foundation meets these goals by awarding matching grants to projects benefiting conservation education, habitat protection and restoration, and natural resource management.
- http://nfwf.org

The Nature Conservancy

- Mission: To preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.
- http://nature.org

New Jersey Audubon Society

- The New Jersey Audubon Society fosters environmental awareness and a conservation ethic among New Jersey's citizens; protects New Jersey's birds, mammals, other animals, and plants, especially endangered and threatened species; and promotes preservation of New Jersey's valuable natural habitats.
- http://njaudubon.org

North American Bird Conservation Initiative (NABCI)

- US NABCI Vision: Populations and habitats of North America's birds are protected, restored, and enhanced through coordinated efforts at international, national, regional, state, and local levels, guided by sound science and effective management. US NABCI Goal: To deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships.
- http://nabci-us.org

Partners in Flight

- Partners in Flight (PIF) is a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. PIF's goal is to focus resources on the improvement of monitoring and inventory, research, management, and education programs involving birds and their habitats.
- http://partnersinflight.org

Partners in Flight – Canada

- http://cws-scf.ec.gc.ca/birds/lb_ot_e.cfm

Partners in Flight – International

- http://partnersinflight.org/pubs/latangara.htm

The Peregrine Fund/World Center for Birds of Prey

- Established in 1970, The Peregrine Fund works nationally and internationally, working to conserve birds of prey in nature. We conserve nature by achieving results - results restoring species in jeopardy, conserving habitat, educating students, training conservationists, providing factual information to the public, and by accomplishing good science. The World Center for Birds of Prey in Boise, Idaho is The Peregrine Fund's world headquarters. At the World Center we propagate birds of prey for release to the wild. Research and educational programs are also conducted.
- http://peregrinefund.org

Point Reyes Bird Observatory

- PRBO Conservation Science is dedicated to conserving birds, other wildlife, and ecosystems through innovative scientific research and outreach. Founded in 1965 as Point Reyes Bird Observatory, our 120 staff and seasonal biologists study birds to protect and enhance biodiversity in marine, terrestrial and wetland systems in western North America.
- http://prbo.org

The Raptor Center

- The Raptor Center at the University of Minnesota College of Veterinary Medicine specializes in the medical care, rehabilitation, and conservation of birds of prey. Working with about 30 eagles, hawks, owls, and falcons that are permanent residents, we reach 250,000 people each year through educational programs and events. The essence of our mission is to strengthen the bond between humans and birds, to improve the quality of life for both, and to contribute to the preservation of the natural world.
- http://raptor.cvm.umn.edu

Rocky Mountain Bird Observatory (formerly Colorado Bird Observatory)

- RMBO was founded in 1988 to address a bird conservation and related public education need in the western U.S. Our mission is the conservation of Rocky Mountain and Great Plains birds through research and public education. We accomplish our mission through numerous research and public education programs which have dual goals: to conserve birds and bird habitat, and to increase people's understanding of birds--how they interact with humans, what habitats they use, and what factors threaten their survival.
- http://rmbo.org

Smithsonian Migratory Bird Center

- Dedicated to fostering greater understanding, appreciation, and protection of the grand phenomenon of bird migration.
- http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds

Southeast Arizona Bird Observatory

- The Southeastern Arizona Bird Observatory (SABO) is a non-profit organization dedicated to the conservation of the birds of southeastern Arizona, their habitats and the diversity of species that share those habitats through research, monitoring and public education.
- http://sabo.org

Vermont Institute of Natural Science

- Protecting Vermont's natural heritage through education and research designed to engage individuals and communities in the active care of their environment.
- http://vinsweb.org

Whitefish Point Bird Observatory

- WPBO is a non-profit membership organization established in 1978 to document and study the birds in the Great Lakes Region, with special emphasis on migration.
- http://wpbo.org

Wildlife Rehabilitation Resources

How to contact a wildlife rehabilitator

- http://tc.umn.edu/~devo0028/contact.htm

National Wildlife Rehabilitators Association

- http://nwrawildlife.org

Wildlife International

- http://wildlife-international.org

The Wildlife Rehabilitation Information Directory

- http://tc.umn.edu/~devo0028/

Utility Resources

Avian Power Line Interaction Committee (APLIC)
- http://aplic.org

Edison Electric Institute (EEI)
- http://eei.org

Electric Power Research Institute (EPRI)
- http://epri.com

Institute of Electrical and Electronics Engineers (IEEE)
- http://ieee.org

National Rural Electric Cooperative Association (NRECA)
- http://nreca.org

Rural Utilities Service (RUS)
- http://usda.gov/rus

V. LIST OF ACRONYMS

APLIC – Avian Power Line Interaction Committee

APP – Avian Protection Plan

BGEPA – Bald and Golden Eagle Protection Act

BMTS – Bird Mortality Tracking System

DMBM – Division of Migratory Bird Management

EEI – Edison Electric Institute

EPRI – Electric Power Research Institute

ESA – Endangered Species Act

GIS – Geographic Information System

HCP – Habitat Conservation Plan

MBTA – Migratory Bird Treaty Act

NESC – National Electric Safety Code

NMFS – National Marine Fisheries Service

NRECA – National Rural Electric Cooperative Association

REA – Rural Electricification Association (currently RUS)

RUS – Rural Utilities Service

USFWS – U.S. Fish and Wildlife Service