

GEOTECHNICAL BASELINE REPORT

I-405, Brickyard to SR 527 Improvement
Project

XL5446, I-405, MP 21.4 – 27.1



Washington State Department of Transportation
Multimodal Development & Delivery
Construction Division
Geotechnical Office
1655 2nd Avenue SW
Tumwater, WA 98512-6951

March 16, 2023

This geotechnical baseline report (GBR) is issued as part of the Request for Proposals (RFP) for the subject project. The GBR has been prepared to provide geotechnical baselines for use by the Design-Builder, as described in Chapter 1 of the RFP. It should not be used, in part or in whole, for other purposes, without contacting the WSDOT Geotechnical Office for a review of the applicability of such reuse.



March 16, 2023

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1 INTRODUCTION

1.1 GENERAL

This Geotechnical Baseline Report (GBR) is issued as part of the Request for Proposals (RFP) for the design and construction of the I-405, Brickyard to SR 527 Improvement Project (Project) on Interstate 405 (I-405) between milepost (MP) 21.40 and MP 27.10 (see Figure 1).

Funded by Move Ahead Washington and Sound Transit, the Project will create a dual express toll lane (ETL) system from south of the I-405/SR 522 interchange to the I-405/SR 527 interchange.

The Project will include multiple retaining and noise walls to support roadway improvements. In addition, six fish barriers with restored stream connections will be constructed as well as stream improvements. The Project will also include drainage improvements, tolling gantries, signing, and intelligent transportation system (ITS) elements with associated cabinets.

The Project will remove bridge piers near SR 522, and new and widened bridges will be constructed.

The Project will construct a new median transit stop south of the NE 160th Street interchange, including Bus Rapid Transit (BRT) elements, elevators, and stairwells. In addition, a new pedestrian structure will be constructed across I-405, connecting the east side and Brickyard Park and Ride to the new median transit stop.

The I-405/SR 522 interchange will be reconfigured, and direct access ramps with BRT stations and a transit hub will be constructed.

New direct access ramps will be constructed at 17th Ave NE. This will include new BRT stations, reconfiguring the Canyon Park, Park and Ride, and partial demolition/reconstruction of the existing pedestrian bridge over I-405. In addition, the Project will install tolling gantries, signing, and intelligent transportation system (ITS) elements with associated cabinets.

The GBR provides contractual representations of the subsurface conditions that are anticipated for the Project. Contractual representations in this GBR referred to as "baselines," are derived from geotechnical information and data collected specifically for the RFP through subsurface exploration, testing, and analysis, as well as a review of other preexisting data. The Project subsurface explorations and laboratory testing results are presented in the Geotechnical Data Reports (GDR). Professional opinions have also been used to help establish the baselines.

The Design-Builder shall not use the GBR baselines in isolation for the planning or performance of any aspects of their Work, including and without limitation as to means

and methods, techniques, sequences, and procedures of construction, and safety precautions to be employed by the Design-Builder. The Design-Builder shall undertake an independent review and evaluation of the Contract Documents, available data, and additional subsurface information obtained by the Design-Builder as part of the Work.

The GBR was prepared based on the geometry and physical location of the Project anticipated in the Conceptual Plans provided in the RFP. References to project feature designations in this report are for clarity and are only applicable to this GBR. Baseline statements included herein do not apply to alternate locations of the Project features that may be proposed by the Design-Builder, or alternatives that do not conform to the conceptual plans. All elevations presented in this GBR are referenced to the North American Vertical Datum of 1988.

Baselines presented in this GBR were developed from existing geotechnical information but shall not be used for design or construed as a guarantee or warranty that those conditions will be encountered precisely as described during the construction process. Ground behavior during construction and performance of the designed project elements will depend on the construction means, methods, and sequences used by the Design-Builder, including equipment and materials.

Where no baseline statement is provided, the Design-Builder shall use the data in the GDR and perform additional explorations to develop bid and design assumptions and constructed means, methods, and sequences.

Refer to Chapter 1 of the RFP for a description of the contractual relationship between the GBR and the GDR, limitations of the subsurface information, the Design-Builder's responsibility for additional subsurface exploration, and constraints on the use of this GBR concerning Alternative Technical Concepts and Differing Site Conditions.

1.2 PURPOSE AND SCOPE

WSDOT prepared this GBR to provide baselines for the purpose of bidding to support the geotechnical design and construction of the Project. The scope of this GBR is limited to bridge foundations, earth retaining structures (i.e., cut and fill walls), noise walls, fish passage structures, ground improvement or reinforcement, and vaults classified as a structure. Throughout this GBR, these features collectively will be referred to as "structures." Other aspects of the design and construction of the Project, including but not limited to at-grade sections (including cuts and fills), pavements, vaults, and utility excavations, are explicitly excluded from the scope of this GBR.

This GBR provides an interpretation of the anticipated physical geotechnical conditions that could be encountered during the Project's design and construction, which may affect the Design-Builder's cost, schedule, and selection of construction means and methods. This GBR is the contractual description of physical conditions the Design-Builder could encounter concerning identifying and allocating geotechnical risks to prepare its Proposal.

2 SUBSURFACE CONDITIONS

2.1 INFORMATION AND DATA SOURCES

The geotechnical data collected for the Project is provided in the GDR. The GDR includes Project specific exploration logs, test data, and groundwater data used in the preparation of the GBR are located in Appendix G. The subsurface investigations for this Project were conducted to provide the data needed for the Design-Builder to develop an informed cost proposal for the Work. However, the explorations contained in the GDR are not sufficient to comply with the WSDOT Geotechnical Design Manual (M46-03) and the AASHTO requirements for the Project. Therefore, the Design-Builder shall be required to perform additional explorations for Contract compliance.

Understanding the geologic history and the depositional processes that produced the soil stratigraphy in the Project area helps evaluate the engineering characteristics and behavior of the deposits encountered along the Project alignment and interpret the stratigraphic correlation between subsurface explorations. Therefore, a reference document has been compiled to include data and information sources from past projects. The reference document contains geological, geotechnical, and regional geology information for the Project area and is provided in Appendix G of the RFP. The reference document is information for the Design-Builder but is expressly not part of the Contract.

3 CONTRACTUAL BASELINE STATEMENTS AND CONDITIONS

3.1 BACKGROUND

To establish baseline statements and conditions, the Project has been divided into four main areas:

- Brickyard area
- Hillside area
- Sammamish River Valley area
- Canyon Park area

Within each main area, subareas have also been defined. Figures 2 and 3 identify the location of each main area and subarea along the Project alignment. WSDOT is performing additional explorations and analyses within the Hillside area, and the information will be provided to the Design Builders in a follow-on supplement.

3.2 BASELINE CONDITIONS

This section describes the anticipated physical ground conditions that could be encountered within the Project limits, which may affect design and construction decisions and, therefore, influence cost, schedule, and the selection of construction means and methods. Ground behavior is the responsibility of the Design-Builder as it is a function of a specific design and construction alternative selected. Based on an interpretation of the Project information, baseline physical conditions have been categorized as follows:

- Obstructions
- Abandoned structures
- Liquefaction
- Slope stability
- Groundwater
- Reuse of material
- Poor ground

A description of each baseline condition is provided below. The purpose is to give the Design-Builder knowledge of what baseline physical geotechnical conditions may be encountered to bid and prepare a Proposal. The baseline conditions represent physical conditions that may be encountered in any design and construction alternative. The descriptions below apply only to the areas indicated in Table 1.

3.2.1 OBSTRUCTIONS

The Project is located along the west-facing slopes of a glacially carved trough occupied by Lake Washington. Several glacial periods within the past 2 million years have dominated the recent geologic history of the Puget Sound Lowland region. Post-glacial deposits and human modification, including fill, are also present throughout the Project.

Based on historical information (documented in Contract Appendix E and other parts of the Contract), area development before and in the 1960s was generally agricultural land with rural residential. However, since the late 1960s, improvements to the I-405 system have been made, including new bridges and roadway widening.

The naturally occurring deposits and human modifications indicate that large-sized natural and artificial materials are expected in the Work. Naturally occurring cobbles, boulders, and miscellaneous natural and artificial debris are present within the Project limits that can cause difficulty in construction. A cobble is a rock that will pass through a 12-inch-square opening but not through a 3-inch-square opening in any orientation. A boulder is a rock that will not pass through a 12-inch-square opening in any direction.

Miscellaneous debris includes, but is not limited to, materials such as lumber, wood, concrete, metal, and brick.

- Rip-rap and quarry spalls are incidental to all work at the surface or buried.
- Cobbles are incidental to all Work
- Boulders up to 4 feet (passing through a 4-feet square opening in any orientation) are incidental to all Work
- All miscellaneous debris with individual pieces up to a volume of 64 cubic feet is considered incidental to the Work

3.2.2 ABANDONED STRUCTURES

Abandoned structures are pylons, pilings, construction debris, and any deleterious material from prior activities of any size shall be the responsibility of the Design-Builder.

In the Sammamish River baseline area, the Sammamish River was a major transportation route between Lake Washington and Lake Sammamish and historic bridges crossed the river. Accordingly, for baseline conditions, underground objects may be encountered including but not limited to wooden piling, historic docking, bridge and other foundations.

In the Hillside baseline area, a variety of underground objects from historic roadways and landslide mitigation will be encountered, including but not limited to piles, foundations, drainage systems, and rip rap rock.

3.2.3 LIQUEFACTION

The Project will be designed in accordance with the current versions of the WSDOT GDM, the WSDOT Bridge Design Manual, and the American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design Bridge Design Specifications. Based on these documents, the proposed structures will require a seismic design. A seismic design includes but is not limited to the development of ground motions and the assessment of liquefaction. Liquefaction effects include ground settlement, reduced shear strength, flow failure, lateral spreading, and pseudo-static slope instability.

Saturated silt to silty-fine sand, sand, and gravel will liquefy during the design earthquake. Liquefaction will result in a reduction in soil strength to residual strength values to a depth of 80 feet below the ground surface. Soils between 80 and 120 feet below the ground surface will experience a reduction in strength but will not degrade to residual strength. Glacially overridden soils are not susceptible to liquefaction. Plastic silt to clay and organic silt will experience a reduction in strength due to the design earthquake. Liquefiable soils will experience post-seismic volumetric strains resulting in ground surface settlement, differential settlement, and down-drag loads on deep foundations. Liquefied soils are unstable and susceptible to lateral spread and flow

failure that will impose lateral loads and or/lateral soil displacements on Project elements.

3.2.4 SLOPE STABILITY

Steep and unstable slopes will be encountered within the Project limits. In addition to topography that has resulted in steep and unstable slopes from the region's geological conditions, the ground stability within the Project limits has been impacted by commercial, industrial, residential, and infrastructure development. Specific physical features included in the slope instability baseline are:

- Ancient landslide locations
- Locations where prior failures have been observed
- Locations where ongoing maintenance actions have been required
- Locations where engineering activities may affect adjacent properties
- Locations where underground utilities may be impacted
- Locations where ground conditions, including but not limited to Glaciolacustrine deposits, indicate a higher likelihood of slope failure

Regardless of what is indicated in Table 1, this baseline condition does not include cases where the Design Builder's design assumptions lead to unacceptable factors of safety for static or seismic conditions.

3.2.5 GROUNDWATER

Variable groundwater conditions will be encountered within the Project limits. Specific issues associated with groundwater that may affect design and construction alternatives include shallow groundwater where excavations or base stability may be affected, seepage from slopes influencing stability, high groundwater inflows, and over-pressured or artesian conditions. In addition, perched, isolated, and continuous groundwater zones will be encountered within the Project limits.

Within a baselined area, the groundwater shall be taken to be at the ground surface. Groundwater zones may have piezometric pressure heads above the top of the saturated soil unit, as high as above the ground surface.

Groundwater will affect design and construction alternatives. For example, dewatering during construction, short-term stability, and long-term impacts.

3.2.6 REUSE OF MATERIAL

For all areas except those explicitly noted in Table 1, materials from roadway excavation, structure excavation, and all other excavations may or may not be suitable for reuse as fill or embankment material on the Project.

3.2.7 POOR GROUND

Variable and poor ground conditions will be encountered within the Project limits. Poor ground conditions are defined as loose granular soil, soft cohesive soil, and organic soil (i.e., including but not limited to peat) that can create the likelihood of immediate and long-term settlement, inadequate bearing strength, and instability during or following the completion of construction. Baseline areas where poor ground conditions are likely to be encountered are identified in Table 1.

Poor ground conditions are defined to occur where uncorrected standard penetration resistance (SPT) blow counts are less than or equal to 10 for non-cohesive soils and less than or equal to four for cohesive soils and all organic soils. Where these physical conditions are encountered, the ground behavior will be controlled by the design and construction decisions of the Design-Builder. Therefore, it shall be the Design-Builder's responsibility to assess these poor ground conditions and their related significance to the structure and the overall design performance to be achieved.

3.3 BASELINES BY AREA

Table 1 defines where the baseline conditions will apply. The locations of the Project components and outlined baseline areas are shown in Figures 2 and 3.

3.4 BASELINE BOUNDARIES

Soil stratigraphy varies in extent, continuity, and thickness. Therefore, there are not enough explorations available in most locations to reliably interpolate between explorations or extrapolate beyond the available explorations.

The baseline conditions in this GBR (Including Table 1) apply to each Project feature type within a boundary as follows:

- Bridge foundations: A lateral distance of 100 feet from the exterior dimensions of the bridge foundation element.
- Earth retaining systems, including retaining walls: A perpendicular distance of 90 feet from the face of the wall, 1.5 times the maximum height of the retaining structures, or the lateral extent of soil anchors, whichever is greater.
- Fish passage structures: A lateral distance of 10 feet from the structure, plus 1.5 times the conceptual depth of the structure, plus another additional 10 feet.

- 1 • Noise wall: A lateral distance of 50 feet from the outer edge of the wall foundation
2 element.
- 3 • Vaults: A lateral distance of 10 feet from the structure, plus 1.5 times the
4 conceptual depth of the structure, plus another additional 10 feet.
- 5 Should the Design Builder elect to move any of the Project features such that permanent
6 or temporary construction occurs outside the baseline boundaries described above, the
7 Design-Builder shall assume and be responsible for any risk of a Differing Site
8 Condition.
9

Table 1: Baseline Conditions

Areas	Approximate Mileposts ¹		Baseline Conditions to be Encountered ²						
	From	To	Obstructions	Abandoned Structures	Liquefaction	Slope Stability	Groundwater	Poor Ground	Reuse of Soil
Brickyard									
	21 40	21 85			NP	NP		✓ ³	✓ ⁴
Juanita Creek fish passage	21 85	21 95	✓		✓	✓	✓	✓	No Reuse
	21 95	22 40			NP	NP		✓ ³	✓ ⁴
Brickyard Transit Station	22 40	22 50			NP	NP		✓ ³	✓ ⁴
	22 50	22 74			NP	NP		✓ ³	✓ ⁴
	22 74	23 10			✓	✓	✓	✓	No Reuse
Hillside ⁵									
	23 10	23 59	✓	✓	✓	✓		✓	No Reuse
Sammamish River Valley									
	23 59	24 00	✓	✓	✓	✓	✓	✓	No Reuse
Canyon Park									
	24 00	24 95			✓	NP	✓	✓	No Reuse
Stream 25	24 95	25 10			✓	✓	✓	✓	No Reuse
	25 10	25 50			✓	✓	✓	✓	✓ ⁴
	25 50	26 10			NP	✓	✓	✓ ³	✓ ⁴
228th St SE	26 10	26 40			✓		✓	✓	No Reuse
	26 40	27 10			✓		✓	✓	No Reuse

NP - Not present

1 - See outlines on Figures 2 and 3

2 - If a part of the table is blank, this condition is not baselined; see Section 1.1. All conditions must be evaluated for design according to the Contract even if a condition is noted in the table as not present.

3 - As a baseline condition, poor ground is not present deeper than 10 feet below the existing ground surface

4 - As a baseline condition, soil may be reused if it meets WSDOT specifications and design assumptions for its use. All soil moisture conditions are fully the responsibility of the Design Builder.

5 - See Technical Requirements, Section 2.6

4 LIMITATIONS

This GBR has been prepared for exclusive use on this Project. The data contained herein is based on site conditions that existed during the field explorations. Within the scope, schedule, and budget limitations, the data presented in this report was collected and presented in accordance with the generally accepted professional geotechnical practice in this area at the time this report was prepared. No other warranty, expressed or implied, is made.

This report was completed to provide prospective Design-Build bidders with geotechnical information. No design recommendations or interpretive information is provided herein.

5 REFERENCES

American Association of State Highway and Transportation Officials, 2020, AASHTO Guide Specifications for LRFD Seismic Bridge Design 2nd Edition, American Association of State Highway and Transportation Officials, Washington, DC.

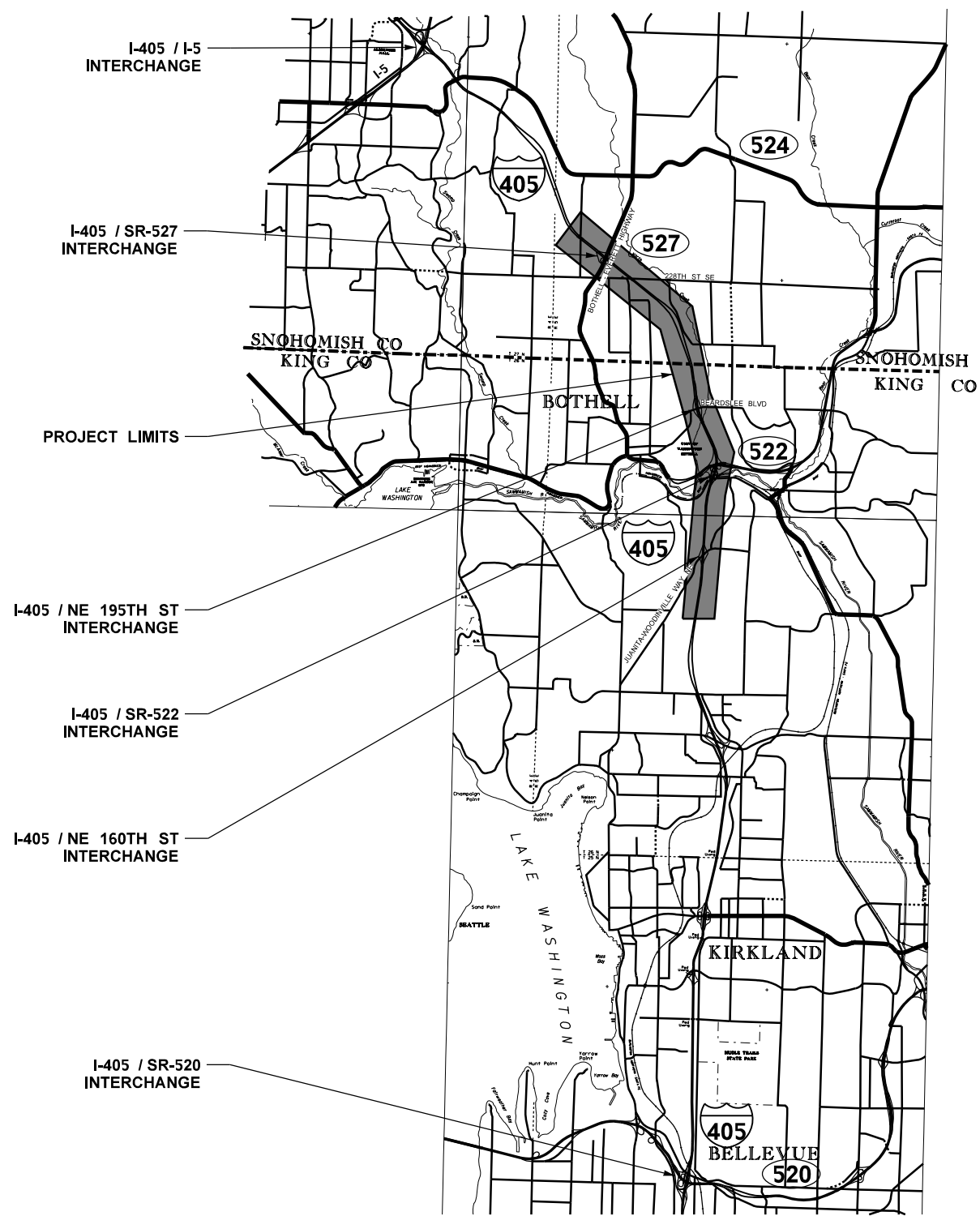
Washington State Department of Transportation, 2022, Geotechnical Design Manual. Publication M 46-03.11. Washington State Dept. of Transportation, Olympia, WA.

FIGURES

- 1 Figure 1: Vicinity Map
- 2 Figure 2: Geotechnical Baseline Overview
- 3 Figure 3: Project Baseline Areas (Sheets 1-18)

I-405

BRICKYARD TO SR 527 IMPROVEMENT PROJECT



PROJECT LOCATION MAP
NTS



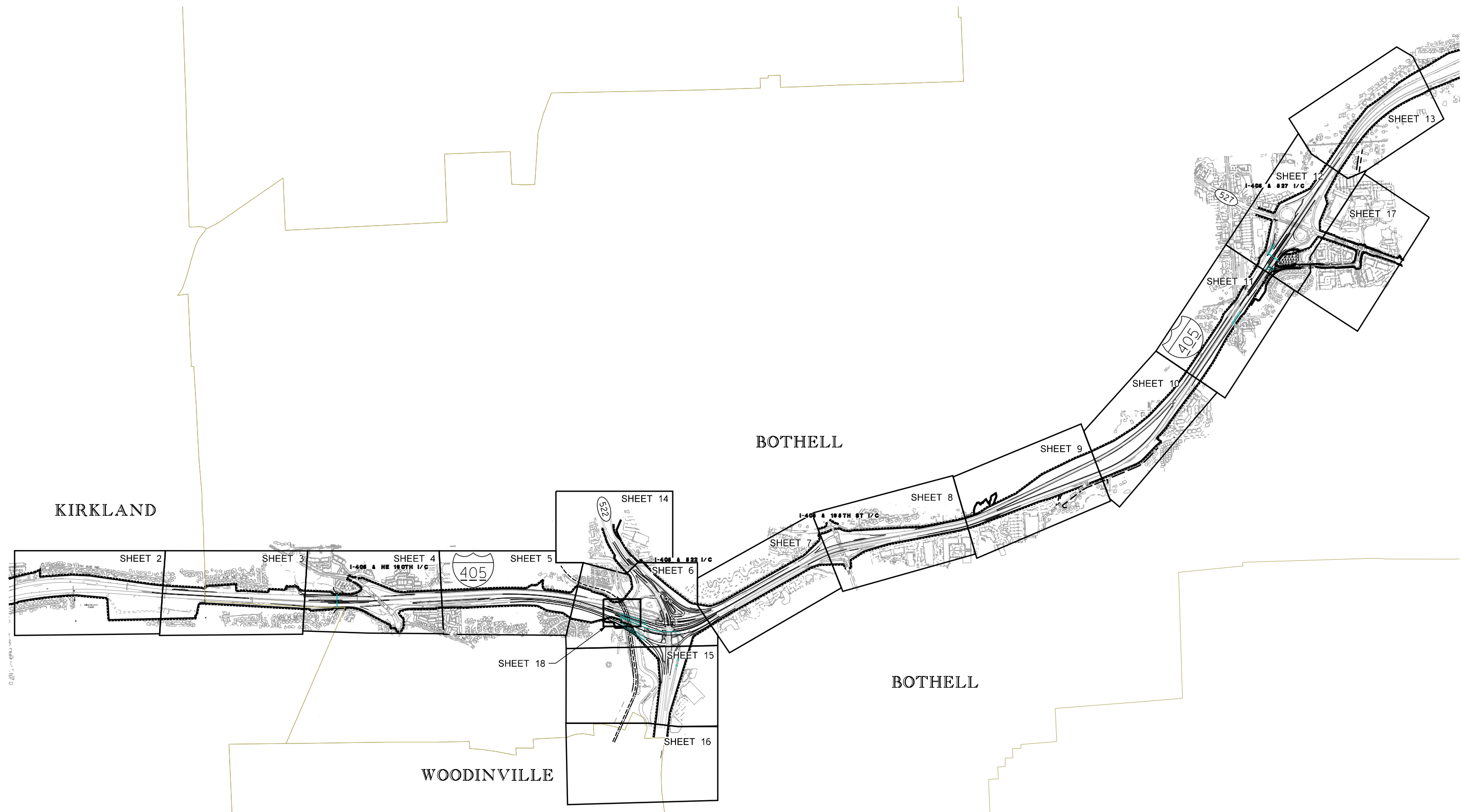
 Washington State Department of Transportation	I-405 SR 522 VICINITY TO SR 527 EXPRESS TOLL LANES IMPROVEMENT PROJECT	SHEET 1 OF 1 SHEETS
	FIGURE 1: VICINITY MAP	

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										P.E. STAMP BOX		DATE		GEOTECHNICAL BASELINE OVERVIEW						

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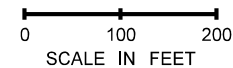
I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

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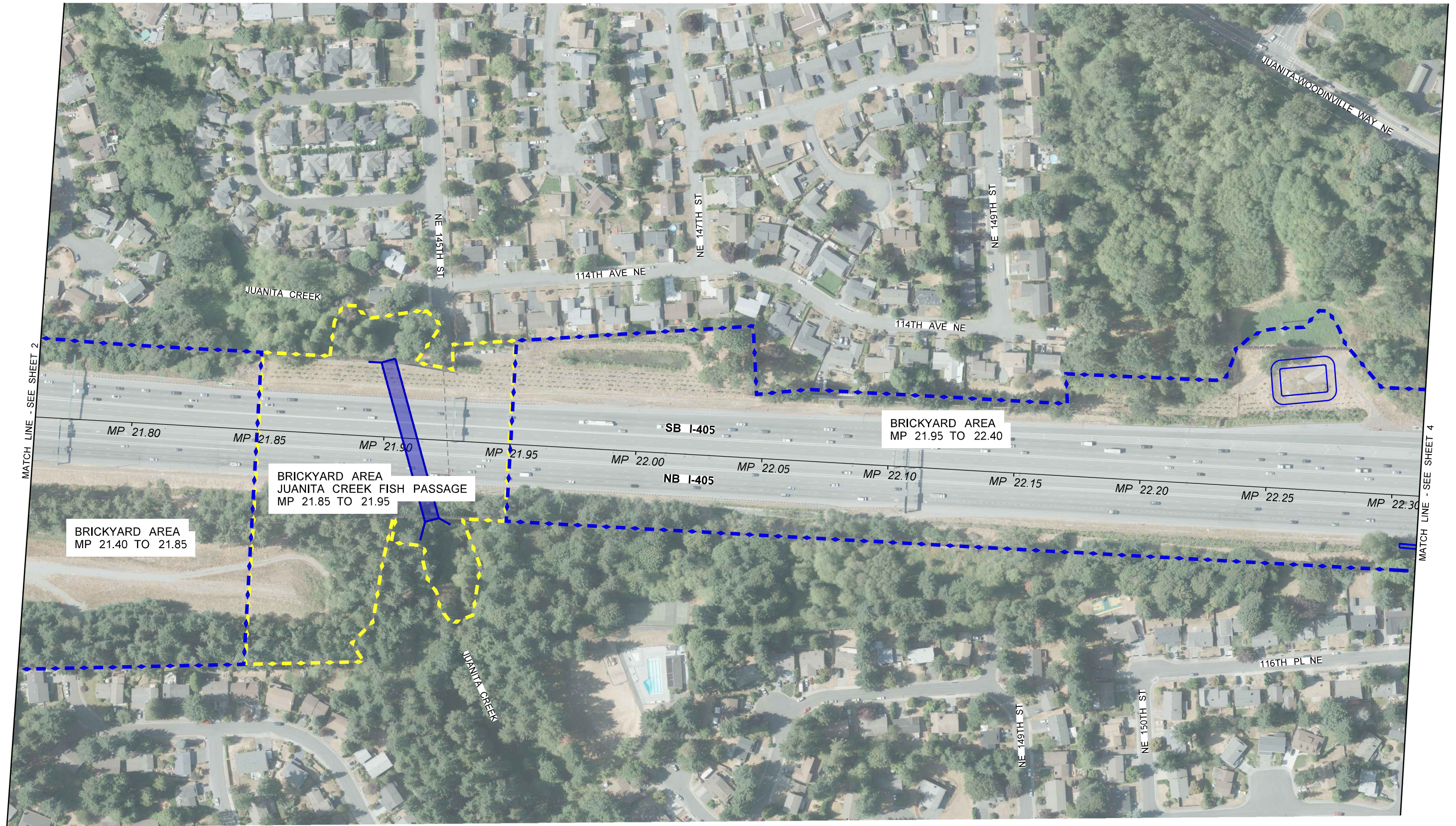


LEGEND	
	LIMITED ACCESS & EXISTING ROW
	PROPOSED RIGHT OF WAY
	PROPOSED TURNBACK LINE
	NEW RETAINING WALL (FILL)
	NEW RETAINING WALL (CUT)
	FISH PASSAGE AND DRAINAGE STRUCTURES
	NEW BRIDGE
	BASELINE AREA
	NEW NOISE WALL
	DETENTION POND



 Washington State Department of Transportation	I-405 SR 522 VICINITY TO SR 527 EXPRESS TOLL LANES IMPROVEMENT PROJECT		SHEET 2 OF 17 SHEETS
	FIGURE 3: PROJECT BASELINE AREAS		

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



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SCALE IN FEET

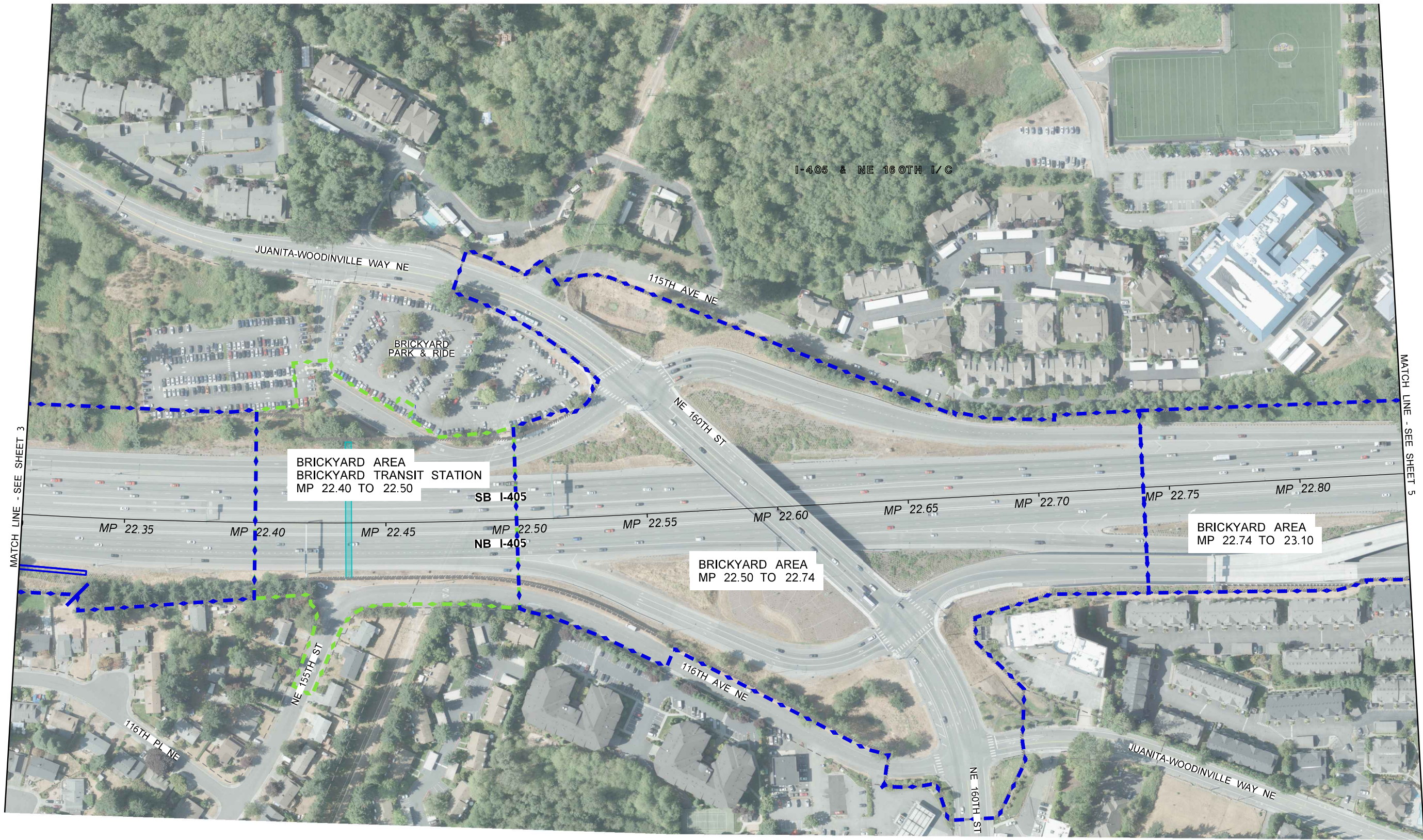


I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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SHEETS

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



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SCALE IN FEET

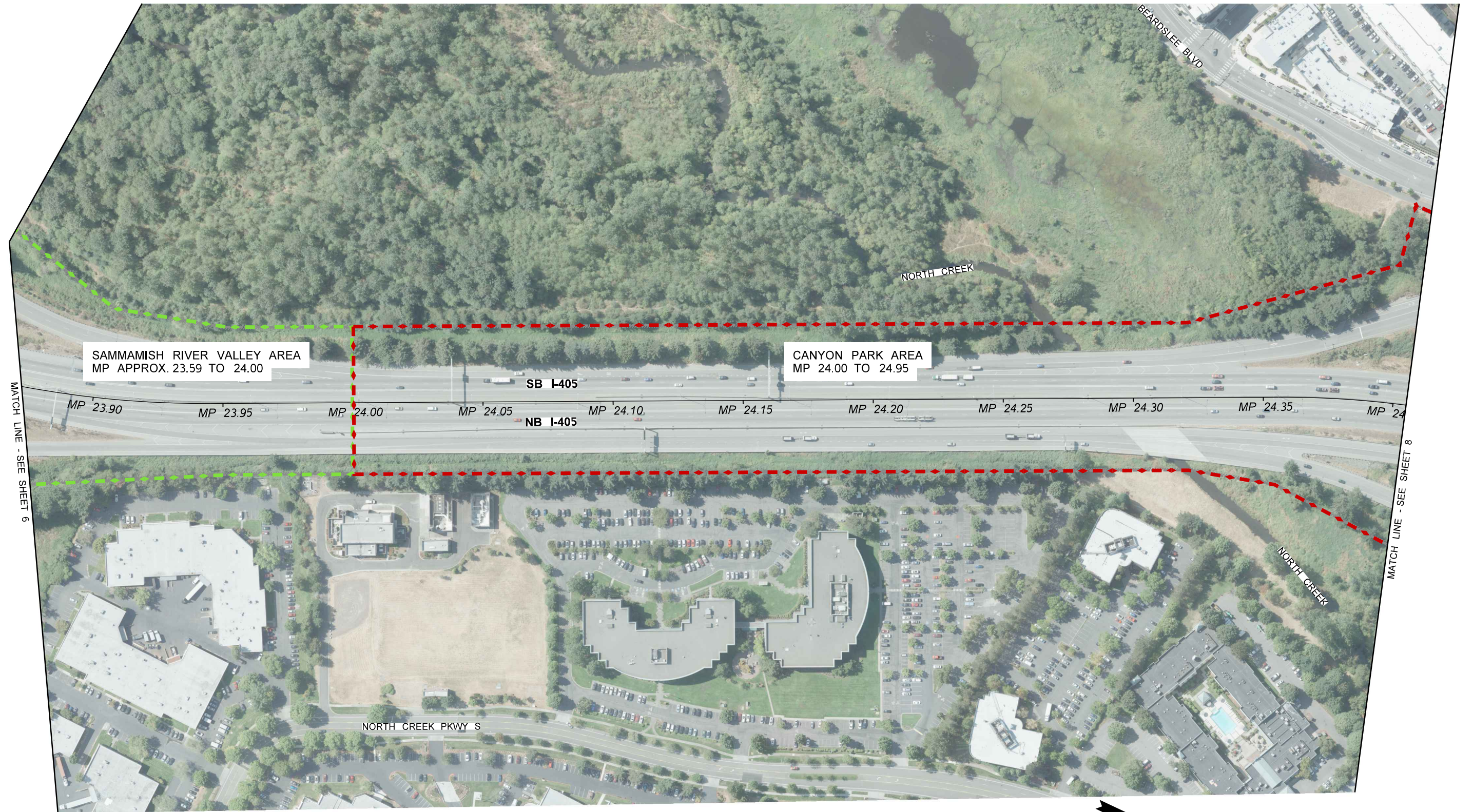


I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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SHEETS

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND

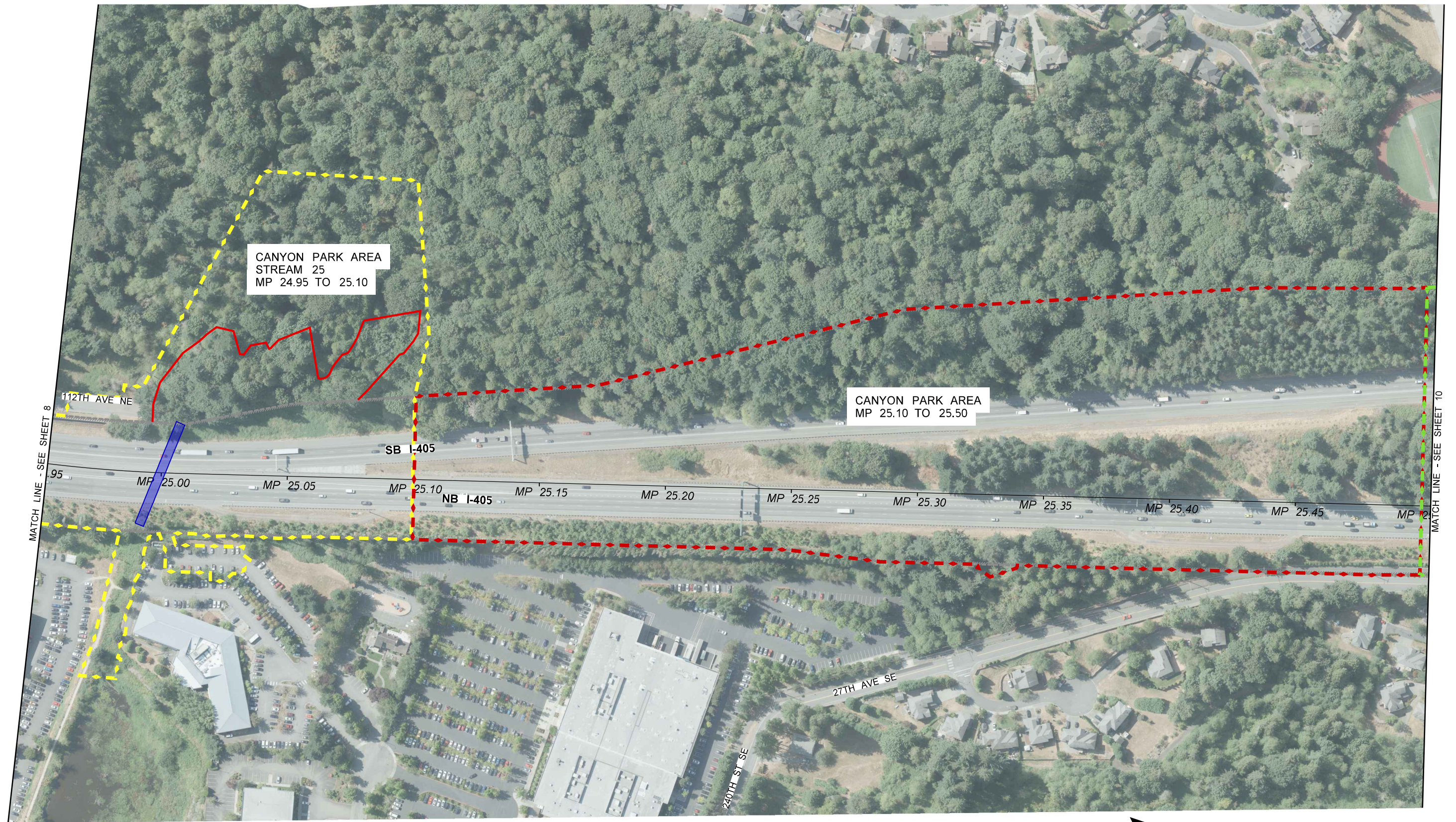


I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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OF
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SHEETS

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
9
OF
17
SHEETS

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SCALE IN FEET

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND

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SCALE IN FEET

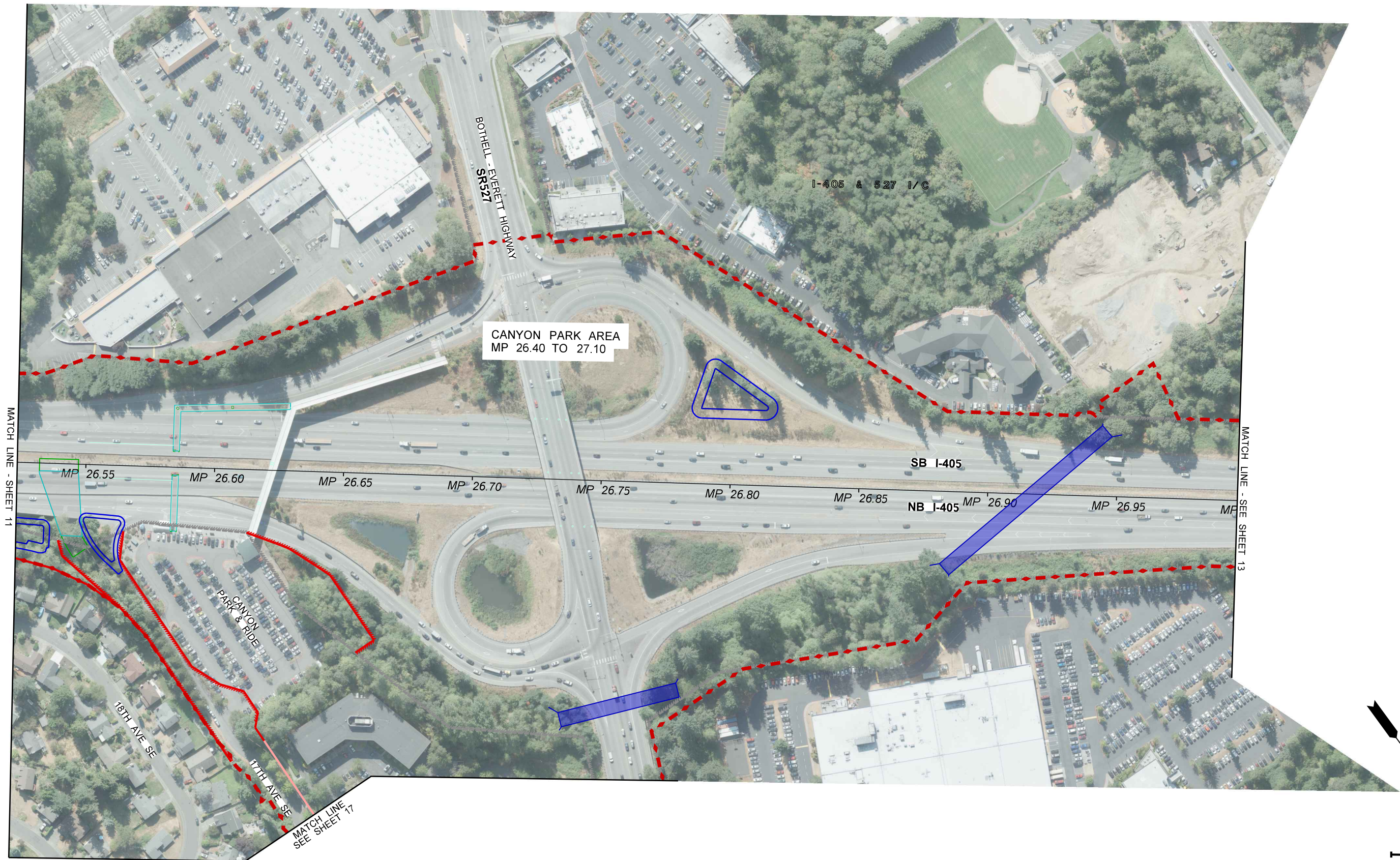


I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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OF
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SHEETS

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND

0 100 200
SCALE IN FEET



I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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OF
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SHEETS

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LEGEND			
	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



I-405
SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

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LEGEND

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| | LIMITED ACCESS & EXISTING ROW | | FISH PASSAGE AND DRAINAGE STRUCTURES |
| | PROPOSED RIGHT OF WAY | | NEW BRIDGE |
| | PROPOSED TURNBACK LINE | | BASELINE AREA |
| | NEW RETAINING WALL (FILL) | | NEW NOISE WALL |
| | NEW RETAINING WALL (CUT) | | DETENTION POND |



0 100 200
SCALE IN FEET



Washington State
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SR 522 VICINITY TO SR 527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

FIGURE 3: PROJECT BASELINE AREAS

SHEET
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OF
17
SHEETS

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LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



0 100 200
SCALE IN FEET



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FIGURE 3: PROJECT BASELINE AREAS

SHEET
15
OF
17
SHEETS

c:\users\taylor\pwworkspace\dotd0536013\XL5446_PS_GBR_016.dgn

LEGEND

	LIMITED ACCESS & EXISTING ROW		FISH PASSAGE AND DRAINAGE STRUCTURES
	PROPOSED RIGHT OF WAY		NEW BRIDGE
	PROPOSED TURNBACK LINE		BASELINE AREA
	NEW RETAINING WALL (FILL)		NEW NOISE WALL
	NEW RETAINING WALL (CUT)		DETENTION POND



0 100 200
SCALE IN FEET



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FIGURE 3: PROJECT BASELINE AREAS

SHEET
16
OF
17
SHEETS

