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April 1, 2019

W1241-A LEVEL 1 HYDRO ASSESSMENT

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Attention: Tim Shell

**SUBJECT: Level One Hydrogeological Assessment
Lacamas Creek Sewer Pump Station Improvements
Camas, Washington**

As requested, GRI prepared this Level One Hydrogeological Assessment for the planned improvements to the Lacamas Creek Sewer Pump Station, an existing sewer pump station located just east of 1642 NE 3rd Avenue, Camas, Clark County, Washington. We understand the pump stations are situated in a designated Critical Aquifer Recharge Area (CARA). Section 16.55 of the City of Camas (City) Municipal Code (CMC) requires assessment of hydrogeological conditions at certain facilities to evaluate whether construction and operation of improvements could adversely affect groundwater quality. This Level One Hydrogeological Assessment was prepared to meet the code requirements.

PROJECT DESCRIPTION

The existing Lacamas Creek Pump Station was constructed in 1958 and is located just east of 1642 NE 3rd Avenue in Camas on the west shoreline of Lacamas Creek (Vicinity Map, Figure 1). The pump station is nearing its design capacity, and many of its components have reached their useful life. The project includes modifications and improvements to enhance the capacity of the system to better serve homes and businesses in the area. Project details include the following:

- Replace the existing pump station with a new pump station at Lacamas Creek Park (Lacamas Creek Park Pump Station) on the north side of NE 3rd Avenue. This pump station will include an on-site backup diesel generator and diesel aboveground storage tank (AST).
- A smaller pump station at Baz Park (Baz Park Pump Station) will be constructed, including a pipe invert at elevation 23.5 ft (National Geodetic Vertical Datum of 1929 [NGVD 29]). This pump station will include an on-site backup diesel generator and diesel AST.
- An infiltration facility will be constructed at the location of the jacking pit at Lacamas Creek Park.

The locations of the proposed improvements are shown on the Site Plans, Figures 2 through 4.

Site Conditions and Topography

The Lacamas Creek Park Pump Station will be constructed in the southern portion of Lacamas Creek Park and immediately north of NE 3rd Avenue, which is constructed on a fill embankment situated over Lacamas

Creek. The ground surface at the location of the pump-station wet well is at elevation 41 ft (NGVD 29) and the overall topography in this area generally slopes downward to the southeast toward Lacamas Creek. The northern portion of the park site is covered with a gravel-surfaced parking lot separated from a grass area by large trees and a row of rocks.

The Baz Park Pump Station will be constructed about 60 ft south of NE 3rd Loop. The park site is vegetated with grass and relatively level at about elevation 34 ft. The ground surface slopes downward to the west, south, and east at inclinations ranging from 3H:1V (Horizontal to Vertical) to 2H:1V to the Washougal River floodplain situated at about elevations 14 to 18 ft. This slope is vegetated with large deciduous and evergreen trees. We understand undocumented fill has been historically placed at the Baz Park site.

More generally and based on our review of U.S. Geological Survey (USGS) mapping, the ground-surface elevation in the project area ranges from approximately 30 to 70 ft (North American Vertical Datum of 1988 [NAVD 88]), and the ground surface is nearly flat to gently sloping down to the Columbia River at grades of up to 15%. Land use in the vicinity of the site is primarily residential, with some light commercial.

HYDROGEOLOGICAL ASSESSMENT

The findings of our assessment are discussed below.

Site Visit

On January 17, 2019, GRI conducted a walking reconnaissance of the site and surrounding area. The project includes force-main and gravity-sewer lines along NE Joy Street, E 1st Avenue between NE Joy Street and NE 3rd Avenue, and NE 3rd Loop between NE 3rd Avenue and Baz Park. The Lacamas Creek Park Pump Station site is an open grassy area surrounded by trees, with asphalt and crushed-rock base to the east closest to Lacamas Creek. Site grades at Lacamas Creek Park slope to the southeast. The Lacamas Creek Park Pump Station site is bounded to the west by residences, with undeveloped park land to the north; Lacamas Creek and residential properties to the east; and the NE 3rd Avenue roadway embankment and residential properties to the south.

The proposed Baz Park Pump Station is located at Baz Park on an open, grassy surface just south of a parking area adjacent to NE 3rd Loop. The ground surface at the site slopes gently to the south before dropping steeply to the Washougal River floodplain to the west, south, and east. Land use in the vicinity is residential and commercial.

Several storm-drain inlets were observed along the project roadways, and one possible drywell was observed just north of E 1st Street, near GRI boring B-2. At least four pad-mounted and 16 pole-mounted transformers were observed along and adjacent to the project roadways. Transformers can contain polychlorinated biphenyls (PCBs), which are halogenated organic compounds historically used in electrical equipment. PCBs are no longer produced; however, some PCB-containing equipment may still be in use. "Non-PCB-containing" placards were not observed on the pad- or pole-mounted transformers. It is possible the units may contain PCBs, although placards were not clearly visible from the ground level on the pole-mounted transformers. No staining was observed below the transformers. No obvious indications of adverse environmental conditions at the site or on adjacent properties were observed. No indications of underground storage tanks (USTs), ASTs, hazardous materials, hazardous waste, solid waste, pits, sumps, staining, odors, or distressed vegetation were observed adjacent to the site during the site reconnaissance.

Summary of Geologic and Hydrogeologic Information

The site is located in the southeastern portion of Clark County, Washington, within a sediment-filled, northwest-trending structural depression known as the Portland Basin, which was formed by structural deformation of underlying Eocene and Miocene volcanic and marine sedimentary rocks. In general, the basin is filled with late-Miocene and younger fluvial and lacustrine sediments overlain by catastrophic Missoula flood deposits (O'Connor et al., 2016). Published geologic mapping indicates both the existing Lacamas Creek Pump Station and the site of the new Lacamas Creek Park Pump Station are underlain by Pleistocene-aged, unconsolidated boulder to cobbly gravel deposits with sand (Qfg, Missoula flood deposits) and more-recent (Holocene- and/or Pleistocene-aged) lower-Washougal River terrace deposits, including unconsolidated, sandy gravel and sand (Qtdw1). The proposed Baz Park Pump Station is on a parcel underlain by Washougal River terrace deposits in the north and Holocene- to Pleistocene-aged alluvium deposits consisting of unconsolidated sand, gravel, and organic-rich mud to the south (Qa) near the base of the slopes and in the lowland area (Evarts and O'Connor, 2008). The Baz Park area is in part overlain by local deposits of fill.

The available mapping shows the northwest-trending Lacamas Lake fault is located approximately 1,500 ft to the north of the proposed Lacamas Creek Park Pump Station. Movement along this fault within the last 1.6 million years has not been documented, although Pliocene activity is constrained by exposures of offset Sandy River Mudstone and the older part of the Troutdale formation (Evarts, 2006).

Hydrogeologic units in the Portland Basin comprise one or more of the geologic units discussed above (McFarland and Morgan, 1996). From youngest to oldest, the eight hydrogeologic units delineated in the basin are as follows:

1. Unconsolidated sedimentary aquifer
2. Troutdale gravel aquifer
3. Confining unit 1
4. Troutdale sandstone aquifer
5. Confining unit 2
6. Sand and gravel aquifer, upper coarse-grained subunit
7. Sand and gravel aquifer, lower fine-grained subunit
8. Older rocks

GRI completed a geotechnical investigation for the proposed sewer line and pump-station sites between September 7 and 12, 2018, by advancing seven borings, designated B-1 through B-7. Borings B-1 and B-2 were advanced on E 1st Avenue, boring B-3 at the proposed Lacamas Creek Park Pump Station site, boring B-4 on the access road to the existing pump station, boring B-5 along NE 3rd Avenue, boring B-6 along NE 3rd Loop, and boring B-7 at the proposed Baz Park Pump Station site. The following table summarizes

general subsurface conditions, and the associated boring logs are considered representative for the general site area.

Table 1: GENERAL SUBSURFACE CONDITIONS

Area	Borings	Subsurface Conditions
NE Joy Street and E 1st Avenue Force Main	B-1 and B-2	Silt from near surface to approximately 3 to 5 ft in depth; gravel below silt to maximum depth explored, about 6.6 to 7.5 ft.
Lacamas Creek Park Pump Station and Jack-and-Bore Crossing	B-3 and B-4	Silt from near ground surface to approximately 7 to 9 ft deep; gravel and gravelly sand below silt to approximately 23 to 25 ft; sand to approximately 35 ft in boring B-3; decomposed basalt below sand in boring B-3 to 46.5 ft and below gravelly sand in boring B-4 to approximately 33 ft; and basalt between approximately 33 and 36.5 ft in boring B-4.
NE 3rd Avenue Embankment	B-5	Fill to the maximum depth explored, about 21.5 ft.
NE 3rd Loop Sewer and Baz Park Pump Station	B-6 and B-7	Fill to 10 ft in boring B-7; silt from near ground surface to approximately 5 ft in boring B-6; gravel below silt in boring B-6 to 16.5 ft and below fill in boring B-7 to approximately 30 ft; decomposed basalt below gravel in boring B-7 to approximately 33 ft; and basalt between approximately 33 and 36.3 ft in boring B-7.

In general, the explorations completed for this project indicate the site is mantled with catastrophic Missoula flood deposits or Terrace deposits. Based on our experience, the units described as silt, sand, and gravel correspond to the unconsolidated sedimentary aquifer, as described by McFarland and Morgan (1996). The fine-grained silt and sand of the upper sedimentary aquifer are generally more permeable than the deeper Troutdale gravel aquifer, which has experienced compaction and cementation over time (Swanson et al., 1993; McFarland and Morgan, 1996). However, the Troutdale formation does not appear to be present at the pump-station locations. The hydrogeologic units present include the unconsolidated sedimentary aquifer that overlays the older rocks.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for Clark County designates most of the site as “Olympic stony clay loam, slopes 3 – 30%,” with a portion of the southeastern site designated “Suavie silt loam, sandy substratum, 0 – 3% slopes.” Olympic stony-clay loam soils have moderately high infiltration rates, are well-drained, and are moderately slowly permeable, while Suavie silt loam soils have moderately high infiltration rates, are somewhat poorly drained, and have moderately slow permeability (McGee, 1972). The NRCS designates a portion of the western site as “Fill land,” for which there are no estimates of soil characteristics. These “Fill land” areas are adjacent to terrain mantled by Olympic stony-clay loam soils.

Groundwater Depth and Flow Direction

Vibrating-wire piezometers (VWPs) were installed in GRI borings B-3 (Lacamas Creek Park Pump Station) and B-7 (Baz Park Pump Station) during the September 2018 subsurface investigation. Groundwater measurements collected from the VWPs between September and December 2018 indicate depth to groundwater in the area fluctuated from 32 to 35 ft at B-3 and approximately 20.7 to 25.7 ft at B-7. Groundwater is assumed to flow toward Lacamas Creek and the Washougal River, which is south to southwest at the Baz Park Pump Station site. We anticipate the groundwater level at the site will closely

reflect the level of the nearby Lacamas Creek and Washougal River and fluctuate in response to the water levels in the adjacent creek and river as well as precipitation. Perched groundwater conditions may develop in the less-permeable, silty zones during periods of heavy precipitation.

Currently Available Data on Wells and Springs

Well logs in the vicinity were reviewed online through the Washington State Department of Ecology Well Log Viewer. The available data indicates no groundwater withdrawal wells or springs are located at either pump station site. Vibrating wire piezometers, similar to monitoring wells, were installed at the Lacamas Creek Park and Baz Park sites during GRI's 2018 geotechnical investigation. According to the available records, 11 resource-protection and four water-supply wells are located within 1,300 ft of the site, the prescribed search radius detailed in Section 16.55 of the CMC. Water-supply well logs reviewed are listed in Table 2, below. No springs were observed on the site or on adjacent properties during our reconnaissance.

Table 2: WATER WELLS WITHIN 1,300 FT OF PUMP-STATION SITES

Well Log ID	Well Depth (ft)	Well Diameter (in.)	Well Owner	State Plane X Coordinate, ft	State Plane Y Coordinate, ft
516396	138	8	City of Camas, WA	1154948	98418
236299	103	20	R.J. Strasser Drilling Company (C.Z. Corp)	1154948	98418
436333	103	20	City of Camas, WA	1158055	98324
236321	112	16	City of Camas, WA	1158485	98970

According to the USGS topographic map of the Camas Quadrangle, Washington-Oregon (2017), Lacamas Creek is located adjacent to the south and east of the existing pump station and approximately 100 ft east of the proposed pump station at Lacamas Creek Park. The Washougal River is located approximately 800 ft south of the proposed Baz Park Pump Station. Movement and discharge of regional groundwater is primarily controlled by the topography, which creates regional, intermediate, and local groundwater-flow systems. The Columbia River is the regional discharge area for the groundwater-flow system in Clark County. Much of the groundwater discharging to the Columbia River from Clark County enters the system in upland recharge areas along the western Cascade Range, moves downward and horizontally toward the river, and finally moves upward to discharge to the river. Regional groundwater in the vicinity of the site generally flows south-southwest toward the Columbia River (Morgan and McFarland, 1996). Local groundwater flow at the site is controlled by the local topography and likely flows from higher elevations at the site generally south towards the Washougal River and east-southeast toward Lacamas Creek.

Location of Other Critical Areas and Wellhead Protection Zones

GRI reviewed critical-areas maps available on the City website indicating wetland areas are mapped along the riparian corridor of Lacamas Creek and the channel and floodplain area of the Washougal River. These wetland areas include the existing pump-station site and are approximately 75 ft from each of the proposed new pump-station locations. Both the Lacamas Park and Baz Park sites appear to be outside the frequently flooded areas (CMC Chapter 16.57) but within a seismic-hazard area (CMC Chapter 16.59).

GRI reviewed the City of Camas Hydrogeology Summary and Wellhead Protection Assessment Report prepared by the Pacific Groundwater Group (PGG, 2016). The report indicates both proposed pump stations are located within wellhead-protection zones.

Best Management Practices (BMPs)

The proposed site improvements will involve use of diesel fuel to provide power to emergency generators at the pump stations in the event of a power outage. The proposed diesel-powered backup generators should be located on new concrete pads and have weather-proof enclosures and internal, secondary containment systems. The concrete pads and diesel generators should be located above the flood zone designated by the Federal Emergency Management Agency (FEMA). The City's operational best management practices (BMPs) include good housekeeping, preventative maintenance, spill prevention and emergency cleanup, employee training, and inspections, reporting, and recordkeeping. A spill kit should be located with each generator. In our opinion, the BMPs proposed for the operational use of the new generators will sufficiently protect groundwater quality. Activities at this site will follow CMC performance standards 16.55.060 and 16.55.070.

Groundwater withdrawal and use do not occur at the site and are not included in the pump-station improvements. In our opinion, the proposed site improvements will not have a significant adverse effect to groundwater quality and quantity at or near the sites.

Chapter 173 WAC Compliance

Design of the proposed pump-station improvements is intended to comply with the containment requirements for petroleum products and tank systems outlined in the Dangerous Waste Regulations, Chapter 173-303, of the Washington Administrative Code (WAC). The backup generators will be new, modern generators with internal, secondary containment systems and installed on concrete pads.

In the unlikely event of a spill or release of petroleum products from the new backup generators, it is the intent of the City to comply with investigation and cleanup requirements outlined in the Model Toxics Control Act, Chapter 173-340 of the WAC.

CONCLUSIONS AND RECOMMENDATION

The existing pump station and the new Lacamas Creek Park Pump Station are located on Pleistocene-aged, unconsolidated boulder to cobbly gravel deposits with sand and more-recent (Holocene- and/or Pleistocene-aged) lower-Washougal River terrace deposits, including unconsolidated, sandy gravel and sand. The proposed Baz Park Pump Station is on a parcel underlain by Washougal River terrace deposits in the north and Holocene- to Pleistocene-aged alluvium deposits consisting of unconsolidated sand, gravel, and organic-rich mud to the south (Qa).

The proposed pump-station improvements will include new pump stations at Lacamas Creek Park and Baz Park, with backup generators and ASTs for storage of diesel fuel. The ASTs should be designed to include the performance standards summarized in Chapter 16.55.070 of the CMC, including having primary and secondary containment systems.

GRI reviewed the City of Camas Hydrogeology Summary and Wellhead Protection Assessment Report prepared by the Pacific Groundwater Group (PGG, 2016). The report indicates both proposed pump stations are located within wellhead-protection zones.

No obvious indications of existing adverse environmental conditions at the site or on adjacent properties were observed during the site reconnaissance. Site-area surficial soils have a relatively moderate infiltration-rate permeability. The depth to groundwater at the site is estimated to be about 20 to 35 ft below the ground surface. Springs were not identified within 1,300 ft of the site.

Based on the work completed for this assessment, it is our opinion the proposed improvements will not have a significant adverse effect on site or vicinity groundwater quality, and the findings indicate no degradation to groundwater is anticipated from the construction and operation of the proposed pump-station improvements.

We recommend submitting this report to the City as part of the permit application for the project.

LIMITATIONS

This report has been prepared to evaluate hydrogeological conditions at the subject sites. The scope of work is limited to the specific project, location, and activities described herein. This report may be used only by the client and project team within a reasonable time from its issuance. Land use, on- and off-site conditions, regulatory requirements, or other factors may change over time, and additional work may be required over time as well.

The conclusions and recommendations presented in this report are based on our interpretation of the data obtained through the procedures described in this report. No other warranty or representation, express or implied, is included or intended in this report.

Please contact the undersigned if you have any questions.

Submitted for GRI,



George A. Freitag

(4/1/2019)

Renews 2/2020

George A. Freitag, LHG
Principal

Gregory D. Martin, LG
Staff Geologist

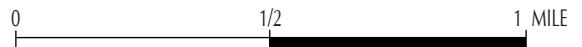
This document has been submitted electronically.

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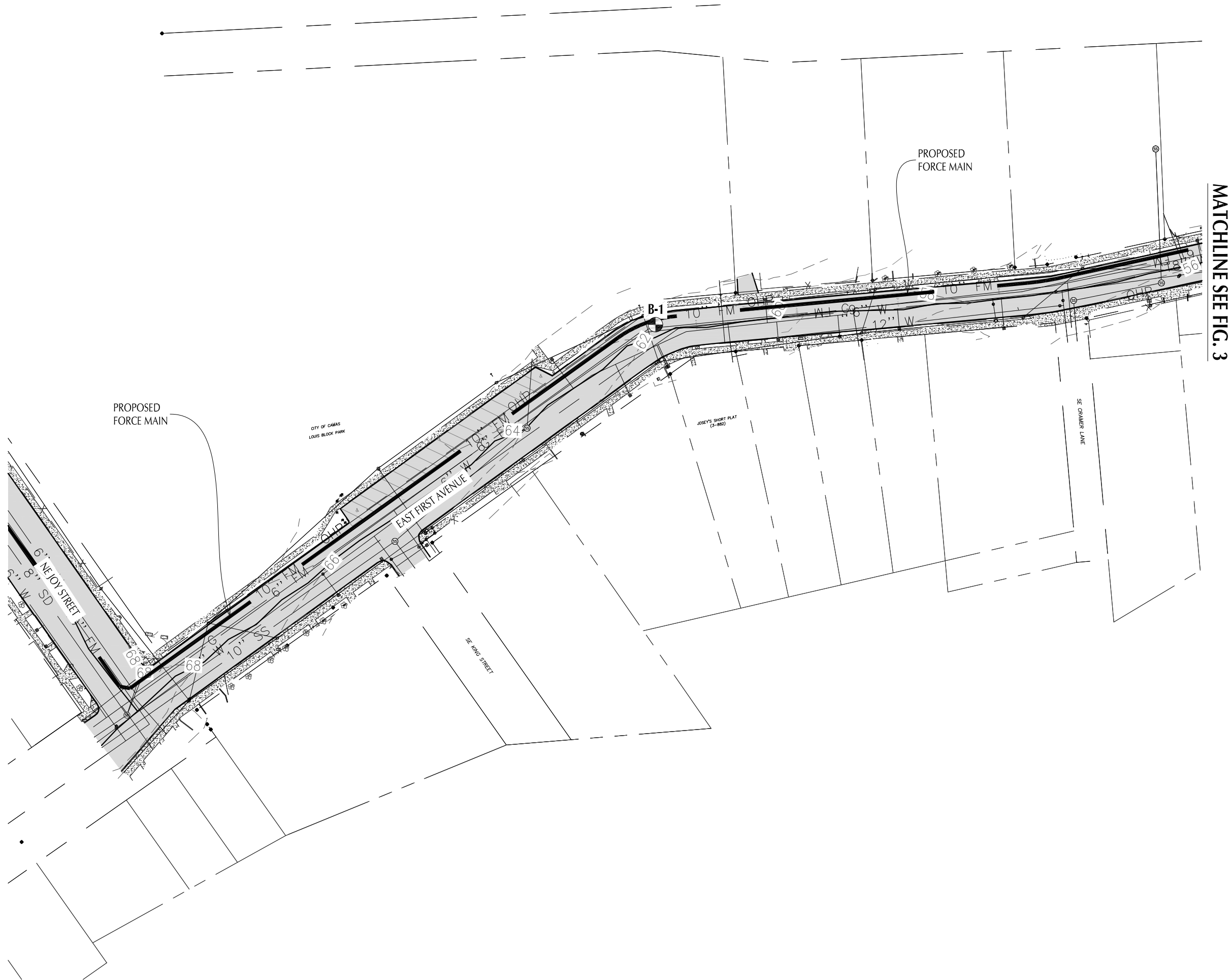


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WALLIS ENGINEERING
 LACAMAS CREEK SEWER PUMP
 STATION IMPROVEMENTS

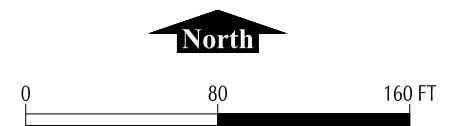
VICINITY MAP



MATCHLINE SEE FIG. 3

 BORING COMPLETED BY GRI
(SEPTEMBER 7-12, 2018)

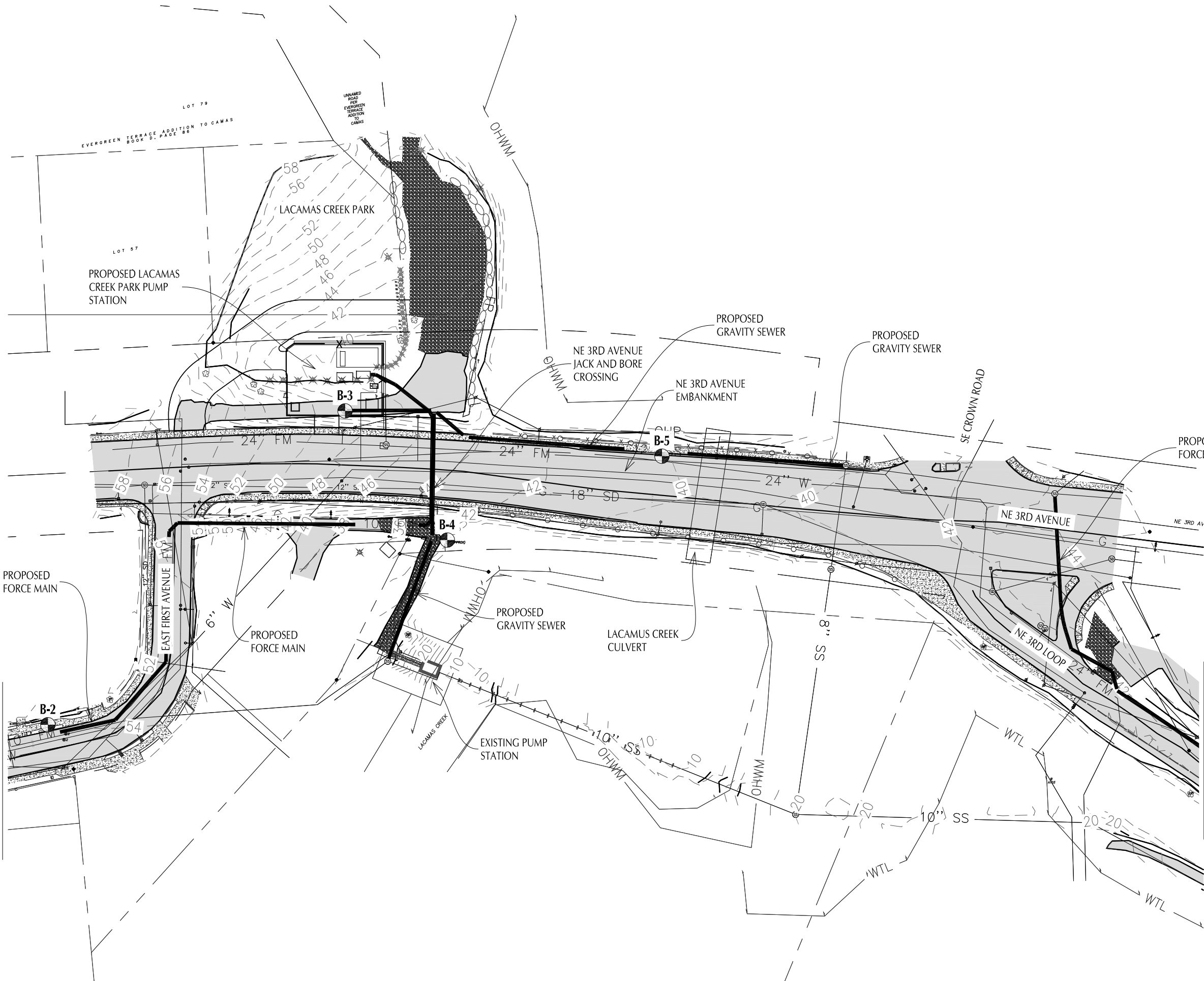
SITE PLAN FROM FILE BY KC DEVELOPMENT



GRI WALLIS ENGINEERING
LACAMAS CREEK SEWER PUMP
STATION IMPROVEMENTS

SITE PLAN

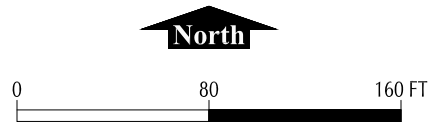
MATCHLINE SEE FIG. 2



MATCHLINE SEE FIG. 4

 BORINGS COMPLETED BY GRI
(SEPTEMBER 7-12, 2018)

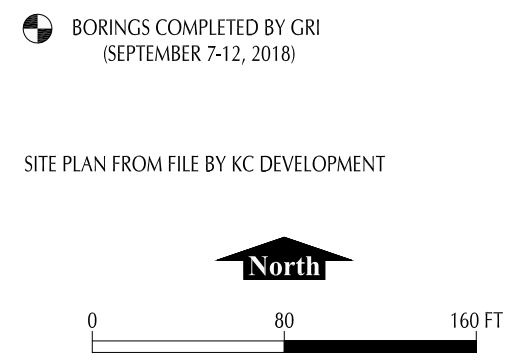
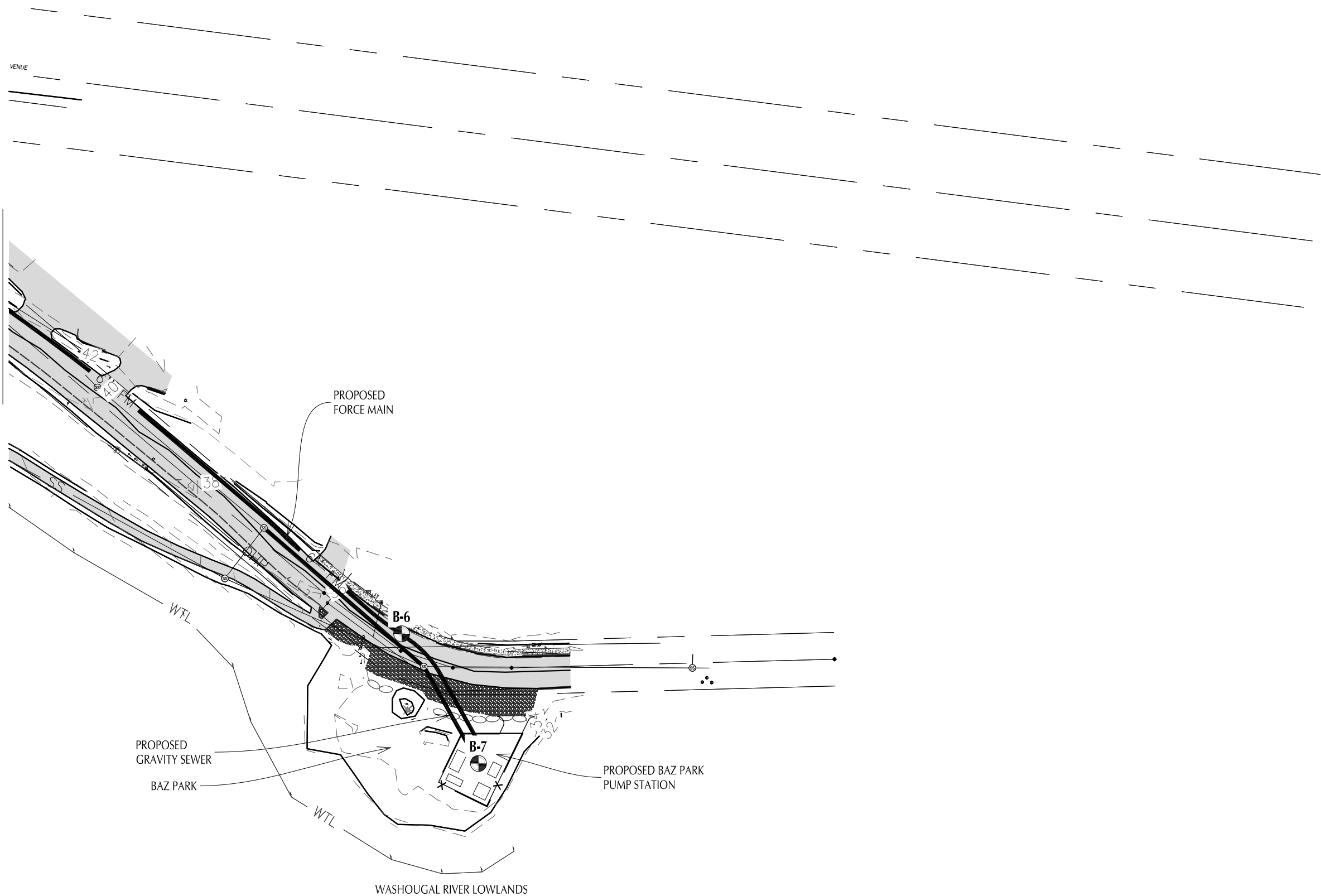
SITE PLAN FROM FILE BY KC DEVELOPMENT



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LACAMAS CREEK SEWER PUMP
STATION IMPROVEMENTS

SITE PLAN

MATCHLINE SEE FIG. 3



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LACAMAS CREEK SEWER PUMP
STATION IMPROVEMENTS

SITE PLAN