Anchor Point SEPA Checklist

Appendix B

Technical Memorandum

To: Tammy Hall, LHG, Washington State Department of Ecology

From: Dan Matlock, LHG, Pacific Groundwater Group

Re: Anchor Point SEPA Technical Support

Date: January 9, 2017

The TransDevelopment Group (TDG) has filed an *Application for Water Right Permit* (G2-30704) for water rights with the State Department of Ecology (Ecology), requesting a new permit in the instantaneous quantity (Qi) of 20,830 gallons per minute (gpm) and the annual quantity (Qa) of 33,630 acre-feet per year (ac-ft/yr). The water will be used for industrial purposes and related supply of the proposed Anchor Point industrial complex.

The new application is subject to a SEPA threshold determination because the Qi is greater than 2,250 gpm (WAC 197-11-310 and 197-11-800(4)). Development of the Anchor Point industrial complex will ultimately require environmental permit approvals that will vary depending on the type of onsite uses, site access and transportation impacts, physical limits of ground disturbance and disruption of vegetation, and other site impacts directly related to construction and land use. The environmental permit approval process will need to address city, county, state and federal regulations. At this stage, only water availability is being addressed. As lead agency, Ecology will review the proposed project under SEPA to determine if the proposed withdrawal of water will have probable adverse impacts on the environment. Pacific Groundwater Group (PGG) has prepared this technical memorandum on behalf of TDG to summarize existing information and research completed for the project as they relate to the water related aspects of the SEPA process.

BACKGROUND

The intent of this project is to develop an industrial complex that is targeted towards heavy, water-intensive industries such as chemical manufacturing. This project is being undertaken as a partnership with the City of Kelso, the property owner (the Winters family), Cowlitz County, and the Washington State Community and Economic Revitalization Board (CERB). The partners recognize the potential for the Anchor Point industrial complex to be a significant economic opportunity in the City of Kelso and southwest Washington.

The proposed water system will be designed to supply multiple tenants and water-dependent manufacturing and processing industries. The intended water supply for the project will be developed with either a series of vertical wells (less than 250 feet) or one or more Ranney-type collector systems. The source of supply (vertical wells or Ranney-type collector) will be located along the Carrolls Channel of the Columbia River, within the north half of Section 14, Township 7 N, Range 2 West.

PROJECT SETTING

The Anchor Point site is the largest industrially zoned property within Kelso city limits. The site is nearly 600 acres of property adjacent to the Columbia and Cowlitz Rivers, the Burlington Northern Railroad mainline, and near Interstate 5 (Figure 1). The land is zoned for heavy industrial use. Current access is an unnamed road at about the 2940 block of Old Pacific Highway South, Kelso.

The Anchor Point site is located in the Cowlitz River drainage basin, designated as Water Resource Inventory Area 26. A formal instream flow protection rule has not been established for this basin under Washington Administrative Code; however, the Cowlitz River basin is regulated by Ecology under the recommendation of the Grays-Elochoman and Cowlitz Watershed Plan.

The site is currently undeveloped and is generally flat. Approximately 295 acres of the northern portion of the site is cleared and covered with stockpiled sand from river dredging activities. Existing ground contours range in elevation from 15 to 60 feet[1]. The western portion of the site is above and outside of the flood plain. The eastern and southern portions of the site contains approximately 305 acres of wetlands (Figure 2). It is anticipated that the acreage of developable land will be reduced by approximately 305 acres of wetlands plus wetland buffers.

The Anchor Point area exhibits typical river valley, lowland topography and vegetation. The climate is a mild Pacific Coastal-type weather setting with the majority of precipitation falling as rain during October through April. Average annual rainfall is about 48 inches. For the Kelso area, average temperatures are in the 70s during the summertime; wintertime low temperatures are in the 30s.

HYDROGEOLOGY

The upland portions of the study area are underlain by low permeability bedrock deposits (sandstones, siltstones, basalt) and lowland areas are underlain by alluvial deposits (sand, gravel, silt, and clay) with variable permeability.

During glacial periods when sea level was over 300 feet lower, the Columbia River scoured a deep channel through the Kalama and Longview areas, which was subsequently backfilled by the alluvial deposits.

Drilling logs for wells in the local area suggest that the alluvial deposits are about 300 to 400 feet thick beneath the lowlands and contain three distinct textural zones. The upper portions of the alluvial deposits that extend from ground surface to about 20 to 150 feet consist of lower permeability silt, clay and silty sand. The deposits below this horizon consist of either moderate to high permeability clean fine sand, low permeability silty sand and gravel, or high permeability clean sand and gravel.

The principal water-supply aquifer for the area occurs in the alluvial deposit as illustrated in hydrogeologic cross sections (Figures 3 to 5). The cross-section alignments are shown in Figure 1.

[1] All elevations are referenced to NAVD88.

The alluvial aquifer system is predominantly recharged by precipitation in excess of evapotranspiration and runoff. Recharge rates are estimated to be on the order of 1.5 feet/year in the lowland area. The Columbia and Cowlitz rivers are the primary points for groundwater discharge, although significant discharge also occurs locally to the Consolidated Diking Improvement District (CDID) drainage canals near Longview.

Well Drilling and Monitoring

Sonic-drilling techniques were used to drill two monitoring wells at Anchor Point in August 2016. Monitoring well MW-1 is located near Carrolls Channel and MW-2 is located further to the north between the Cowlitz River and a seasonal wetland (Figure 2). Continuous sonic cores of the material encountered during drilling were collected at each well. In addition, Shelby Tube samples of undisturbed, fine-grained deposits were collected at MW-2 for permeability testing. The materials penetrated during drilling at MW-1 were generally too coarse-grained, or of insufficient thickness to collect a Shelby Tube sample.

Well MW-1

One of the objectives for drilling at the location of MW-1 was to evaluate if low permeability silt, clay, and silty sand deposits encountered at other nearby wells (Winters, City of Kelso, Port of Kalama - Figure 1) extended below the bottom of the Carrolls Channel, or if the underlying sand aquifer was hydraulically connected to the Carrolls Channel. The borehole at MW-1 was drilled to 80 feet below ground surface, or approximately -47.5 feet elevation. The target drilling depth was identified based on the elevations of the bottoms of the nearby Carrolls Channel (approximately -31.5 feet) and Columbia River (approximately -57 feet).

The materials encountered at MW-1 generally consisted of fine sand with layers that were organic and/or slightly silty in the upper 35 feet below ground that overlay clean (very little silt or clay content) fine sand to 80 feet below ground. A layer of silt with wood was identified from approximately 25.5 to 27.5 feet below ground (7 to 5 feet elevation) and a layer of clay was encountered from approximately 27.5 to 29 feet below ground (5 to 3.5 feet elevation). The lower permeability aquitard described in logs for nearby wells (Winters, City of Kelso, Port of Kalama) was not encountered during drilling at MW-1.

Well MW-2

MW-2 was drilled to evaluate the deposits that underlie a seasonal wetland located immediately to the east (Figure 2). The borehole at MW-2 was drilled to 30 feet below ground, approximately -11.4 feet elevation. The materials encountered at MW-2 generally consisted of slightly gravelly fine sand to approximately 9 feet below ground, layered silt with roots and sand from 9 to approximately 12.5 feet below ground, silt with organics from 12.5 to approximately 20 feet below ground and slightly sandy silt from 20 to 30 feet below ground. These deposits appear to act as an aquitard (confining layer) to the underlying clean sand subunit that would be the supply aquifer for the Anchor Point project. Slug tests and lab permeameter tests conducted on soil samples collected at MW-2 indicate vertical hydraulic conductivities on the order of 0.04 to 0.008 feet/day. A water budget analysis of an on-site wetland body indicated a vertical hydraulic conductivity of 0.009 feet/day.

Monitoring

As described above, exploratory drilling of MW-1 indicate that the lower permeability aquitard unit pinches out in the vicinity of Carrolls Channel, which allows for enhanced hydraulic coupling between the supply aquifer and nearby surface water bodies. The proposed vertical supply wells and Ranney Collectors would be located close to Carrolls Channel to take advantage of this hydraulic coupling.

PGG monitored surface water and groundwater levels in the Anchor Point project vicinity in August and early October 2016. Monitoring stations included wells MW-1 (aquifer) and MW-2 (aquitard), Carrolls Channel, two stations in Owl Creek, and a stormwater pond near the south side of the Anchor Point site (Figure 2). The North Wetland (wetland area 1) was dry during field investigations in late August 2016, and was therefore not instrumented. Water level monitoring was established at two stations in Owl Creek in early October 2016 (Figure 2).

The data indicate a high degree of coupling between Carrolls Channel and the aquifer at MW-1, a more limited degree of coupling between the channel and the aquitard at MW-2, and no discernible coupling between the channel and the stormwater pond indicating that this water body is perched relative to the aquifer levels (Figure 6).

A plot of water level data in the Columbia River collected at NOAA's Longview gage (Figure 1) is presented in Figure 7 for comparison of water levels measured in Carrolls Channel for these investigations to a longer-term dataset.

GROUNDWATER FLOW MODEL

A conceptual hydrogeologic model of the groundwater flow system was developed from driller's well logs in the region extending from the City of Kelso and City of Longview to the Port of Kalama. The conceptual model was refined using the data collected from drilling Anchor Point wells MW-1 and MW-2 and other onsite monitoring efforts. The conceptual model was then incorporated in a groundwater flow model to assess groundwater availability, to estimate the magnitude and geographic extent of drawdown associated with pumping up to 30 mgd from the site, and to assess potential effects to nearby wetlands. Attention was particularly focused on drawdown at the water table, which presumably supports wetland-type areas[2] in the site vicinity (Figure 2).

The model was developed using the U.S. Geological Survey's numerical modeling code MODFLOW2005. The model represents such key hydrogeologic features as the alluvial deposits (both lower permeability aquitard and higher permeability aquifer subunits), surrounding bedrock, surface-water features (Columbia River, Cowlitz River and Carrolls Channel), and proposed groundwater withdrawals by vertical wells or Ranney Collectors (Figure 8).

Recharge from precipitation was not simulated since it was not needed to estimate the drawdown from pumping or associated induced seepage losses from wetland areas. The model was run in

[2] Note that the wetland-type areas identified for the project are representative of areas that appear to be wet at least seasonally in aerial photos but these are not necessarily representative of delineated wetlands.

steady-state mode to represent equilibrium conditions. The model was run both with and without the proposed Anchor Point groundwater withdrawals.

EXPECTED PROJECT EFFECTS

Groundwater

Drawdown of the water table resulting from groundwater withdrawal from vertical wells and Ranney Collectors are presented in Figures 9 and 10 respectively. The predicted on-site drawdown near the developable footprint of the site (i.e. non-wetland areas) range from approximately 6 to 20 feet. Drawdown estimated for the vertical wells is slightly less than drawdown estimated for the Ranney Collectors, presumably because of differences in geometry between the two groups of extraction points relative to the river and the edge of the aquitard[3].

A water rights evaluation was conducted by PGG as a preliminary step in the expected processing of the Anchor Point water right application. The evaluation did not identify any neighboring water rights holders that were likely to be impaired by the planned withdrawals of the project. Most nearby water rights were for small domestic supplies for locations in the bedrock uplands to the east and south of the project site. These users are hydraulically disconnected from the proposed source aquifer. Other municipal or industrial water rights in the area (mainly in the Port of Longview area) were determined to be far enough away that any water level drawdown effects (if any) would be small and would not result in impairment. This evaluation will be expanded and described for the Report of Examination completed during water rights processing. It will be reviewed by Ecology for concurrence or modification.

Surface Water

Owl Creek, which is a tributary of the Columbia River, flows into the mainstem between the mouths of the Cowlitz and Kalama River. Owl Creek flows from bedrock uplands east of I-5 onto lowlands adjacent to Carrolls Channel. Near the old Pacific Highway crossing, Owl Creek becomes a low-gradient stream and wetland complex and is impassable to fish due to a blockage less than a mile from the mouth. Below the blockage, Owl Creek supports fall Chinook, Coho, fall Chum, and winter Steelhead. Based on water level monitoring at two stations in Owl Creek during October 2016, some or all of this lower reach appears to be tidally influenced.

The amount of surface water capture from Owl Creek by the proposed production from the target source aquifer will be limited by the lower permeability skin of the streambed that limits the hydraulic connections. However, in order to provide a conservative approach in evaluating water use effects, PGG assumed that surface water bodies in the project area would be affected (at least indirectly) by production from the underlying source aquifer. The model predicts that drawdown resulting from the withdrawal of 30 mgd from either vertical wells or Ranney Collectors would be

[3] Because the Ranney Collectors are simulated as constant head features, the laterals closest to the channel will collect the most water, as they maintain a higher head difference (gradient) from the channel. Whereas the channel is simulated with a head of 10 feet the Ranney Collectors required a simulated head of -20 feet to achieve the desired 30 mgd.

less than 3 feet in the target source aquifer under the lower reaches (i.e. west of I-5) of Owl Creek (Figures 9 and 10).

In addition, PGG used the model to estimate the induced leakage (seepage loss) in the lower reaches of Owl Creek that may result from drawdown in the underlying aquifer. For this analysis, the lower reaches of Owl Creek were identified as Wetland Area 8 (Figures 9 and 10). The model estimate of vertical leakage was then used to calculate that the estimated amount of flow required to maintain constant head in Wetland Area 8 is 0.4 gpm (Table 1). Mitigation measures for Wetland Area 8 are described in the preliminary wetlands analysis (ELS, 2017).

Wetlands

A significant portion of the site, as well as adjacent property, is composed of a mixture of freshwater emergent and freshwater forested shrub wetland complexes. The functions that an individual wetland performs depend on its location, surrounding topography, subsurface geology, amount and duration of water, and the types of plants present. Wetlands can be largely isolated from groundwater fluctuations or highly sensitive to changes in groundwater levels.

In order to provide a conservative approach in evaluating water use effects, PGG assumed that the wetland bodies would be affected (at least indirectly) from production from the underlying source aquifer. PGG used the model to estimate induced leakage (seepage loss) that would result from lower aquifer water levels (drawdown) below the wetland features shown on Figure 2 as well as from Owl Creek. Modeled drawdowns in the target source aquifer under the wetland areas range from less than 1 to 8 feet. The estimated induced leakage and amount of water needed to maintain water levels in the wetland features are presented in Table 1.

The seepage values presented in Table 1 represent the amount of water that might be needed to maintain wetland water levels under the 30 mgd project pumping scenario, assuming that all of the wetlands are dependent on groundwater discharges to maintain their function. By assuming that wetland water level elevation reflects a high-value wetland condition, the estimated seepage loss numbers are deemed to be conservative. Field investigations of the wetlands will help determine the validity of this approach. Under non-pumping conditions, most of the wetland bodies show significant seasonal water variation that correlates to water level variations of the Columbia and Cowlitz rivers. Water levels of other wetlands, including those along I-5 (wetlands 4, 5, and 8 – Figure 2), are more heavily influenced by runoff from the upland areas to the east.

A preliminary wetlands analysis was completed by Ecological Land Services (ELS) of Longview, WA (ELS, 2017). ELS characterizes all of the wetland areas as open water, emergent, shrub-shrub and forested type wetlands. The wetlands have formed on generally low-permeability soils (Caples silty clay loam and Clato silt loam; NRCS Web Soil Survey) which, coupled with the organic mat that typically builds up in wetland environments, will restrict downward infiltration of the surface water into the deeper aquifers underlying the site. Therefore, drawdown of the localized water table of each wetland as a result of the proposed project will be minimal.

ELS identified that wetlands 1, 6, and 7 could be improved by introduction of groundwater pumped from the proposed project wells, using culverts to control the surface water levels, and discharging clean stormwater runoff or treated wastewater to locations that would help support the wetland functions. These improvements would fully offset any potential impacts from the proposed pumping and may provide side benefits to neighboring or downstream wetland areas (wetlands 2 and 8 primarily, possibly wetlands 3 and 4 to a lesser extent). In all cases, it is ELS's opinion that the proposed withdrawal of 30 mgd will not adversely impact the wetland functions.

Additionally, we anticipate that future phases of the project will each include site-specific evaluations of wetland areas that neighbor the development area. This will allow for additional review of the wetland conditions and function and a refinement of the mitigation approaches.

Conclusion

The amount of water requested by the applicant is large, however it is legally and physically available and can be developed on this site without detriment to senior right holders or instream flows. Aside from the on-site wetlands, no surface water impacts were identified. The wetland areas, if impacted, can be enhanced or mitigated though application of project water to maintain water levels. No impacts to groundwater users were identified.

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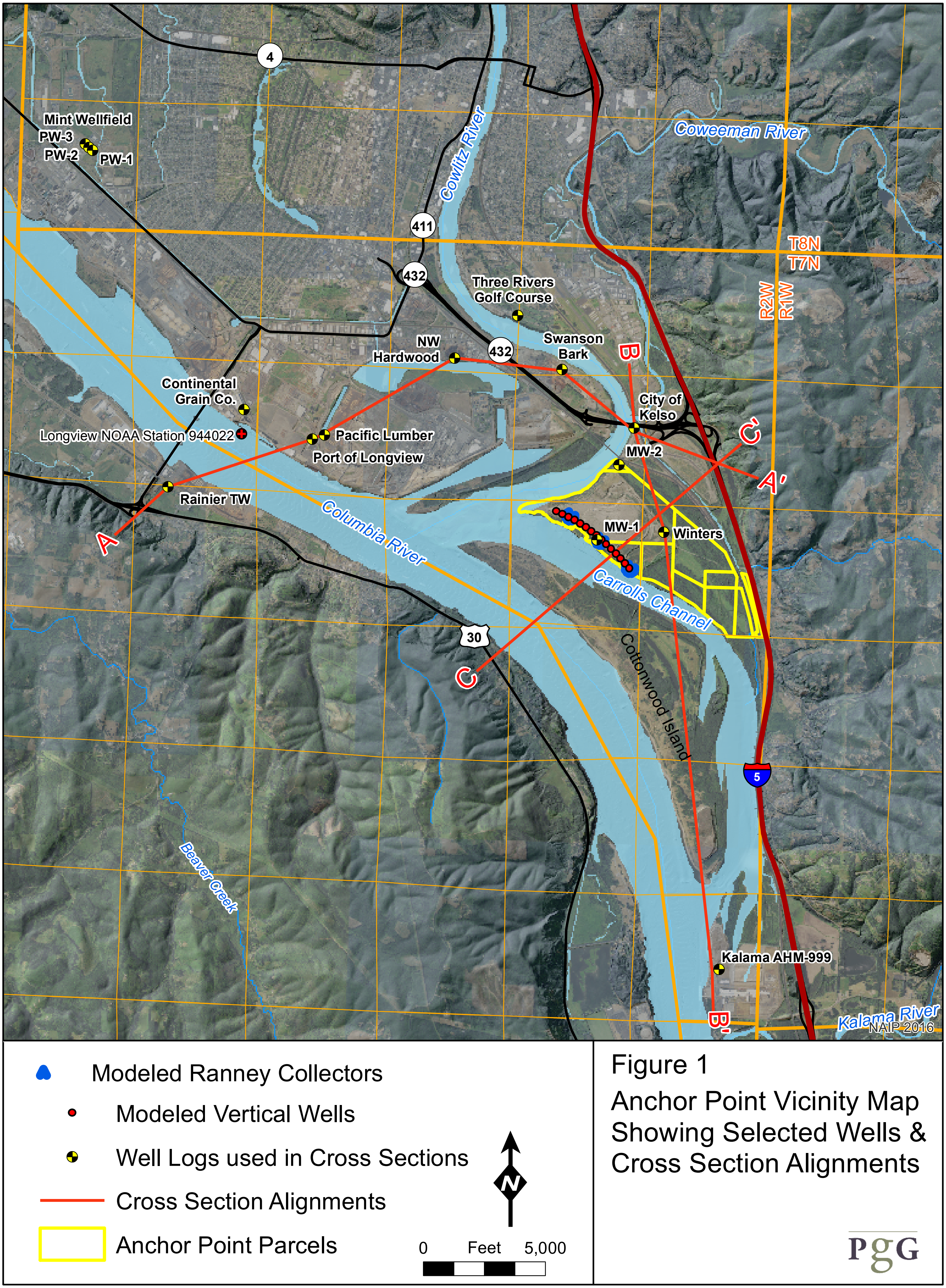
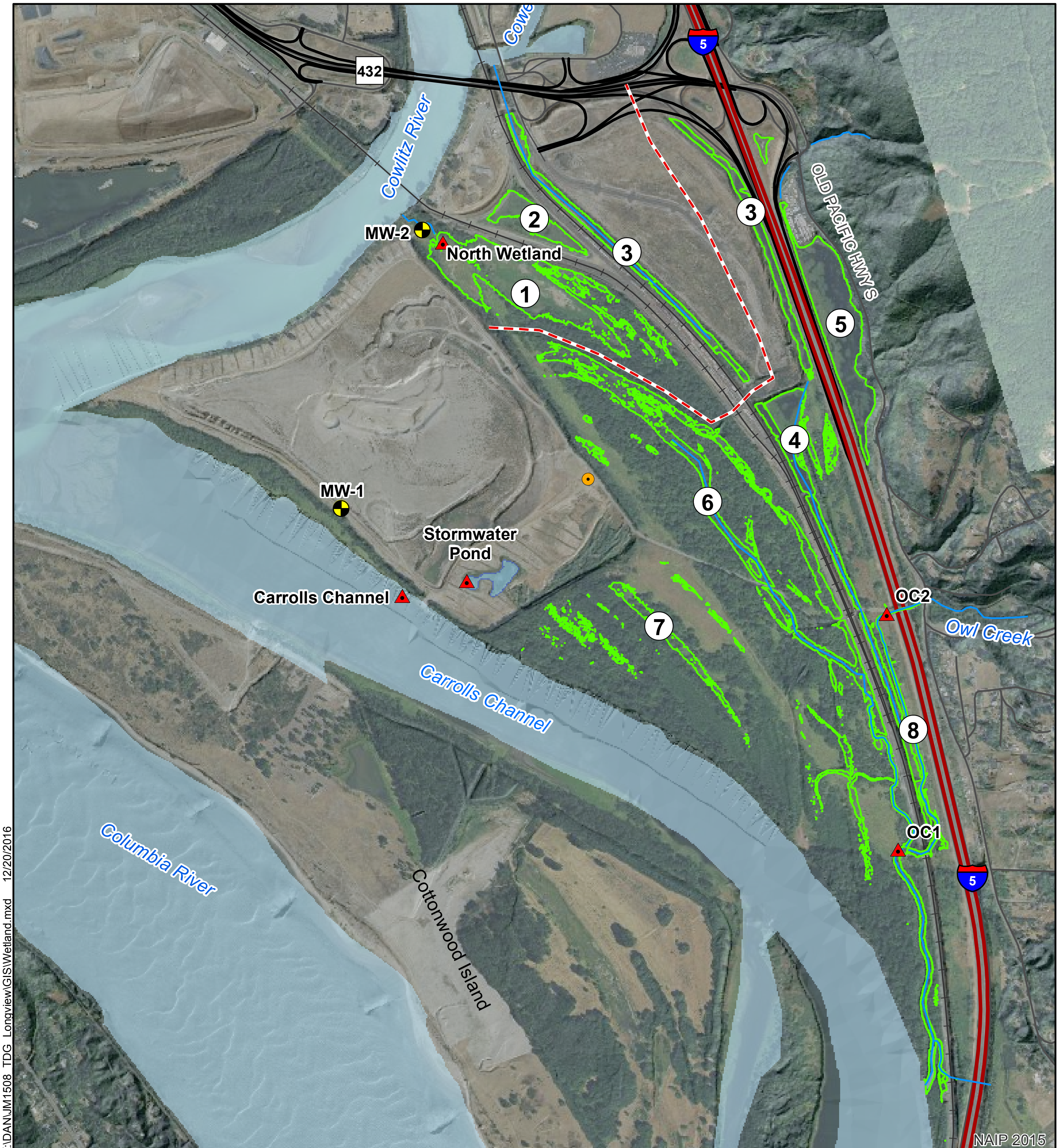


Figure 1
Anchor Point Vicinity Map Showing Selected Wells & Cross Section Alignments

PgG



Groundwater Monitoring Well

Surface Water Monitoring Station

Winters Well

4 Modeled Wetland Area

Estimated Surface Water Divide

N

0 Feet 1,500

Figure 2
Anchor Point Vicinity Map Showing Modeled Wetland Areas

PGG

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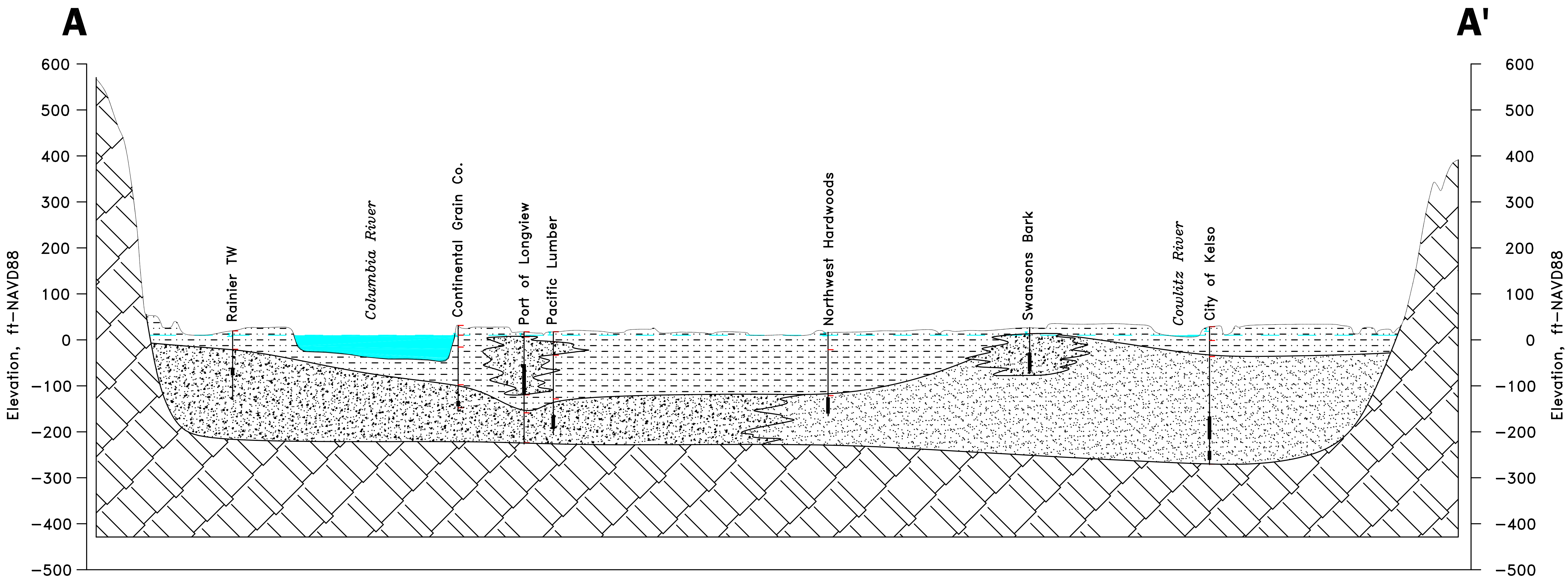


LEGEND

- Silt, Clay and Silty Sand
- Sand
- Clean to silty Sand and Gravel
- Sandstone
- Static Water Level
- Open Interval
- Approx. Water Table

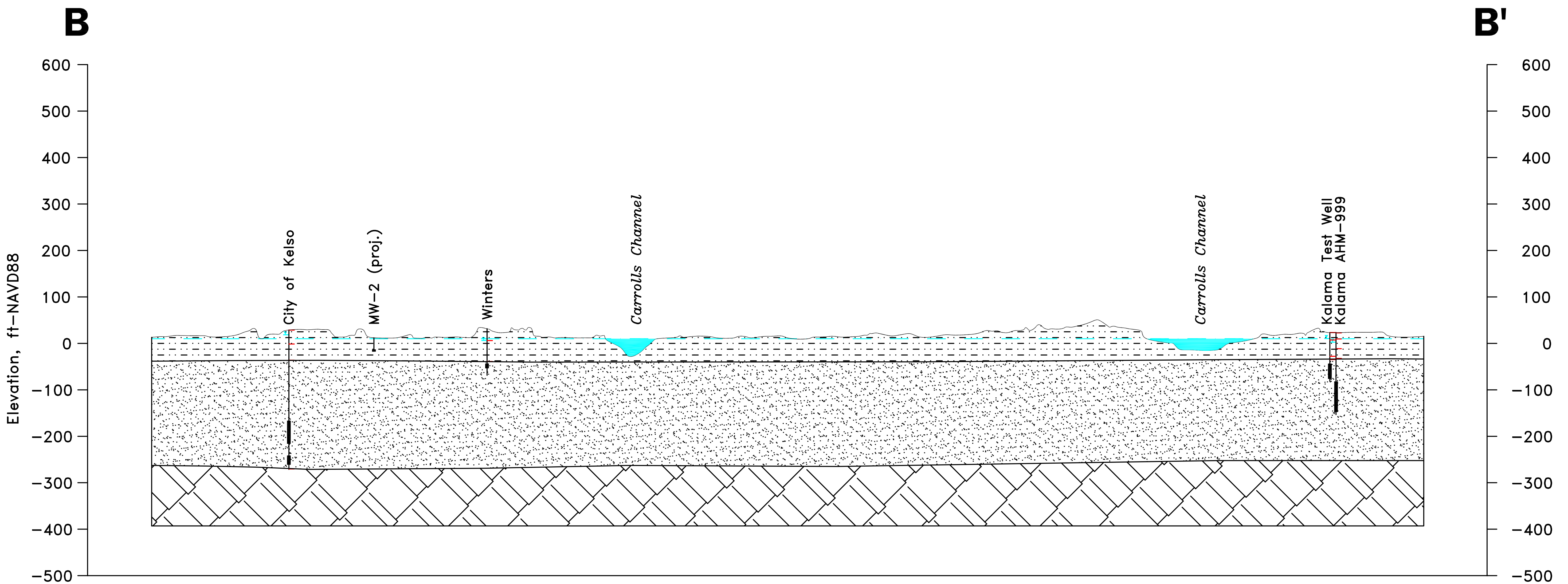
Horizontal Scale in Feet
0 1000 2000

0 100 200
Vertical Scale in Feet

FIGURE 3
Hydrogeollogic Cross Section A-A'

Anchor Point Water Right Procurement
JOB JM1508, XSecA.DWG, June/2016

PgG



LEGEND

- Silt, Clay and Silty Sand
- Sand
- Clean to silty Sand and Gravel
- Sandstone
- Static Water Level
- Open Interval
- Approx. Water Table

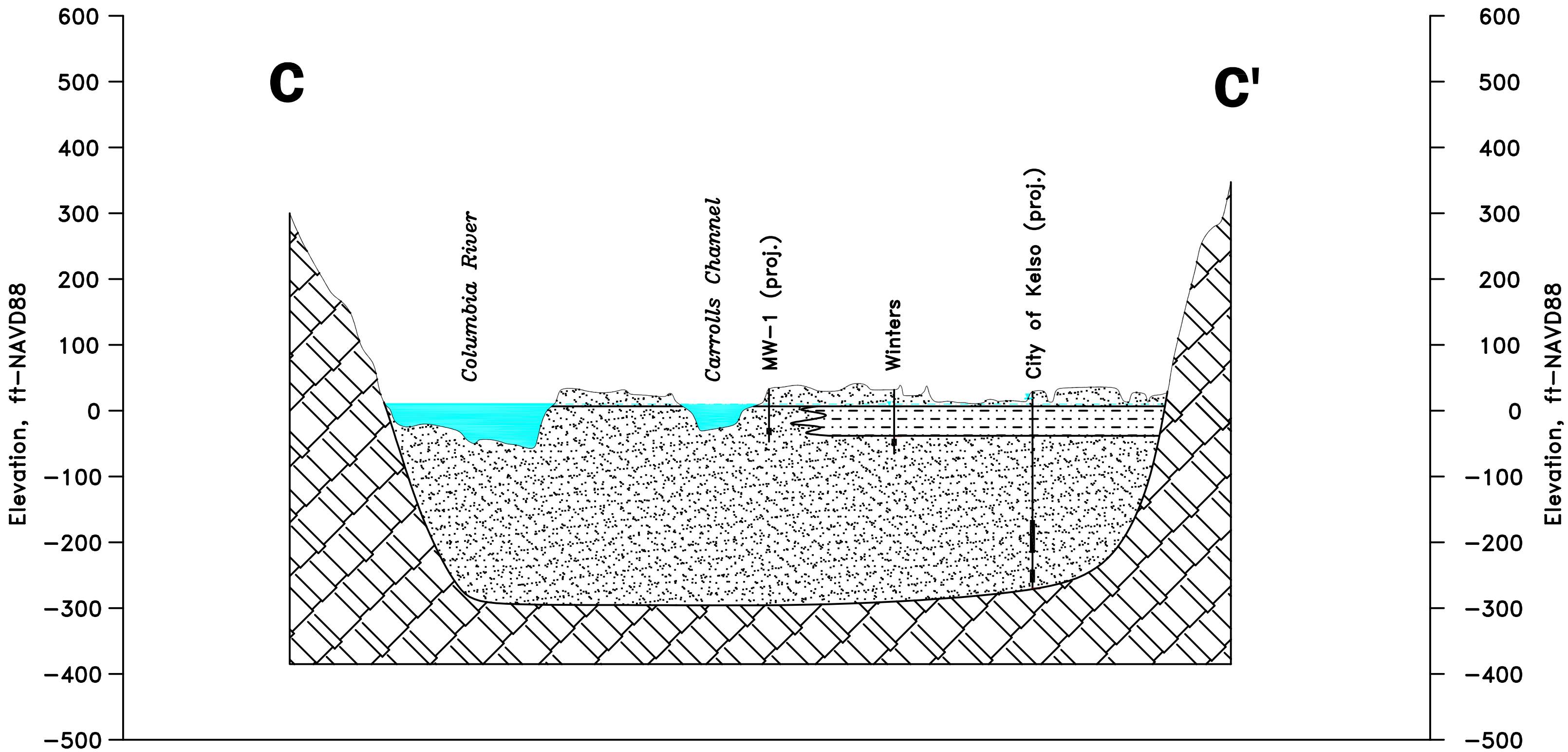
Horizontal Scale in Feet: 0, 1000, 2000

Vertical Scale in Feet: 0, 100, 200

FIGURE 4
Hydrogeollogic Cross Section B-B'

Anchor Point Water Right Procurement
JOB JM1508, XSecA.DWG, June/2016

PGG



LEGEND

Silt, Clay and Silty Sand

Sand

Clean to silty Sand and Gravel

Sandstone

Static Water Level

Open Interval

Approx. Water Table

Horizontal Scale in Feet
0 1000 2000

0 100 200
Vertical Scale in Feet

FIGURE 5
Hydrogeollogic Cross Section C-C'

Anchor Point Water Right Procurement
JOB JM1508, XSecA.DWG, June/2016

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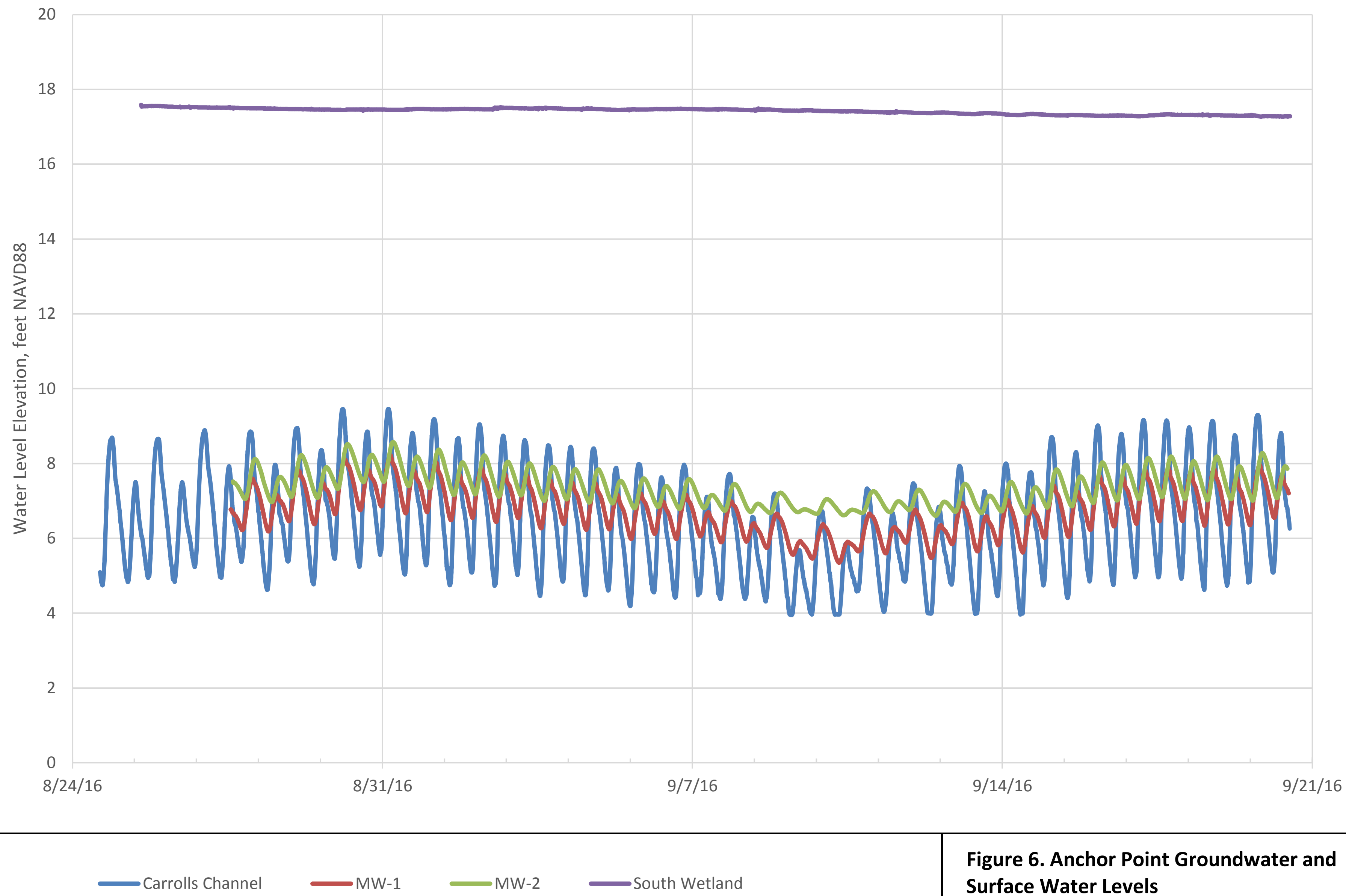

Figure 6. Anchor Point Groundwater and Surface Water Levels

TDG Longview
JM1508

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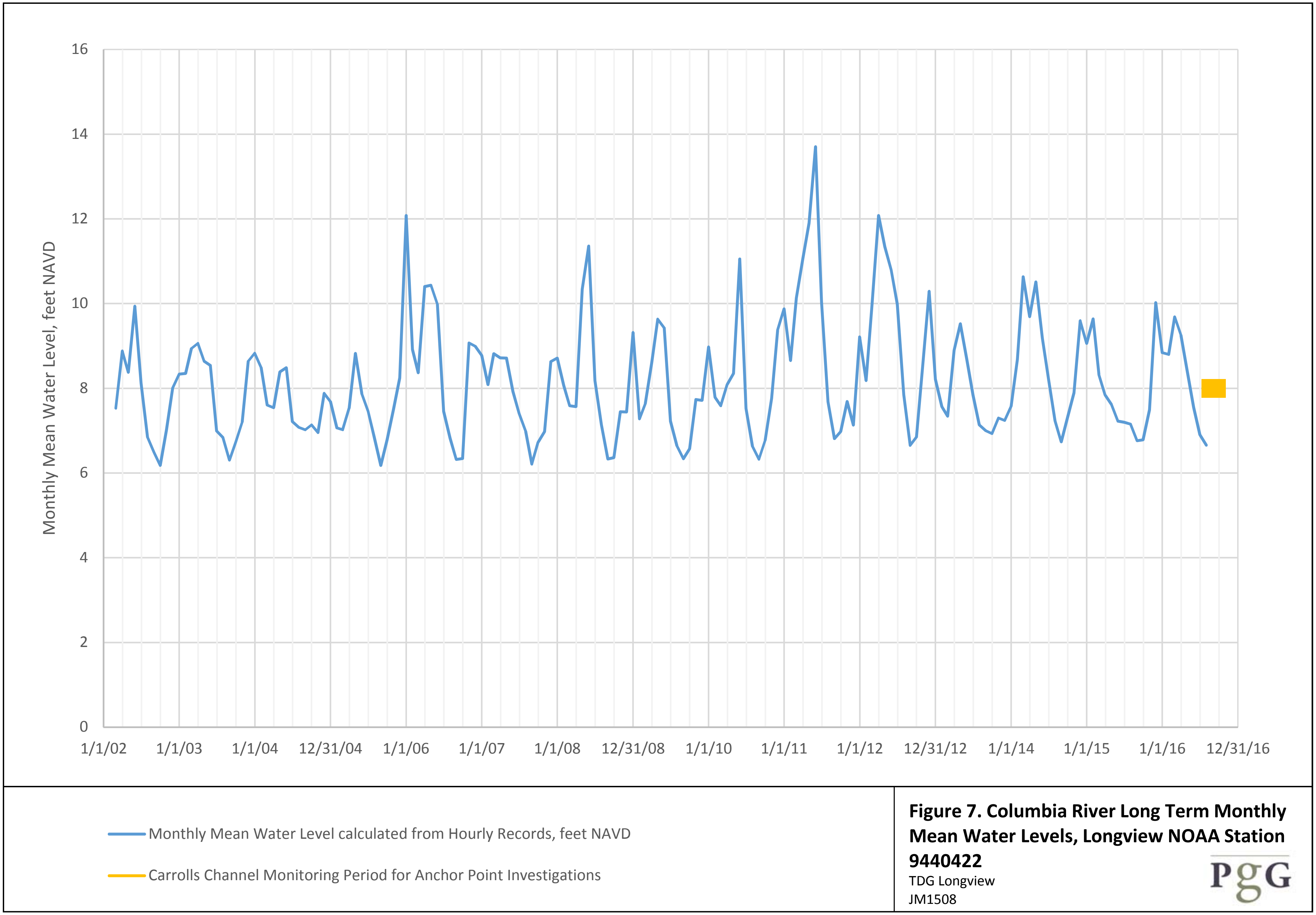

Figure 7. Columbia River Long Term Monthly Mean Water Levels, Longview NOAA Station 9440422

TDG Longview

JM1508

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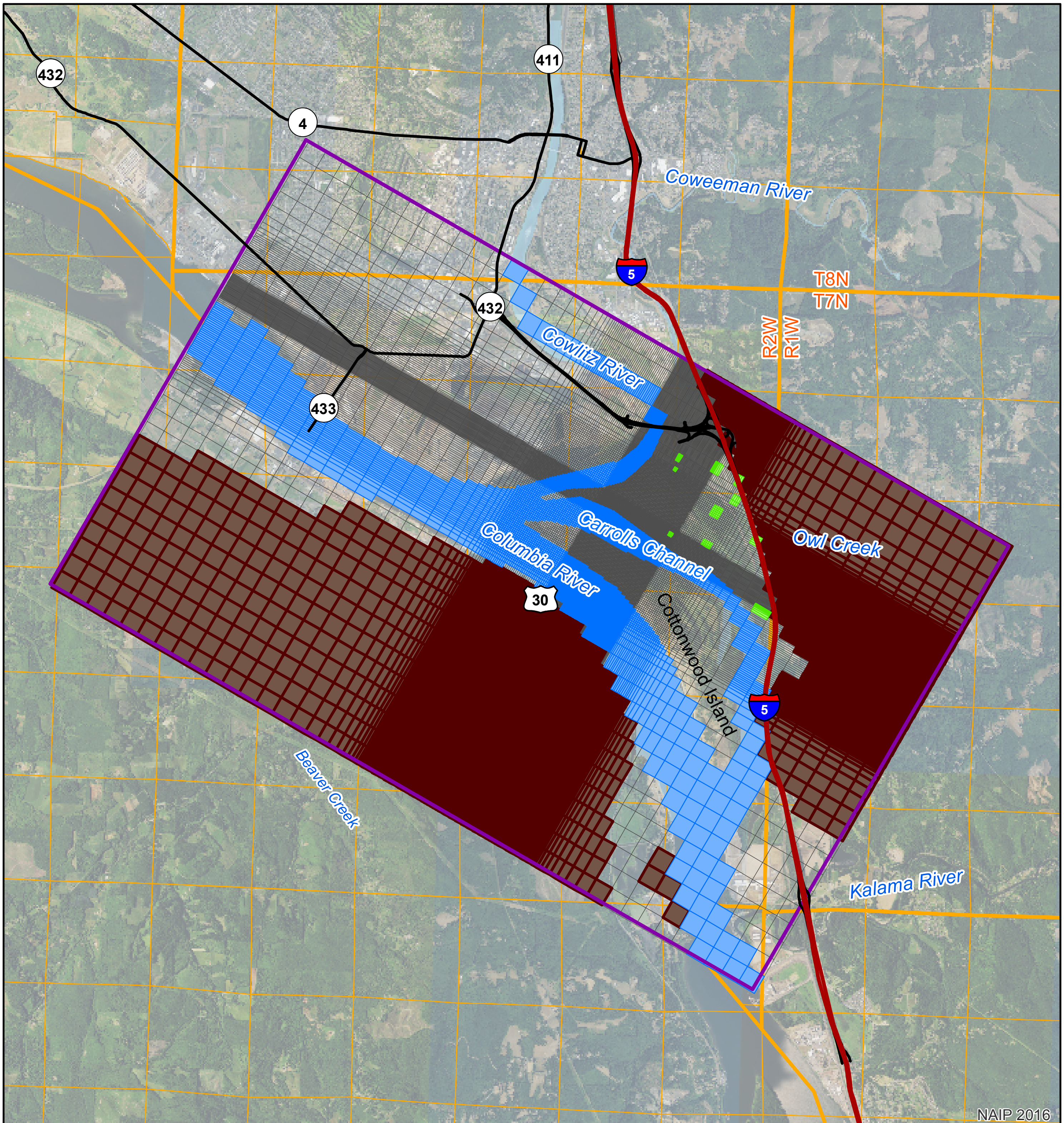

Model Extent

Wetlands

Channels

Bedrock

Model Grid

N

0 Feet 5,000

Figure 8

Groundwater Flow Model Domain

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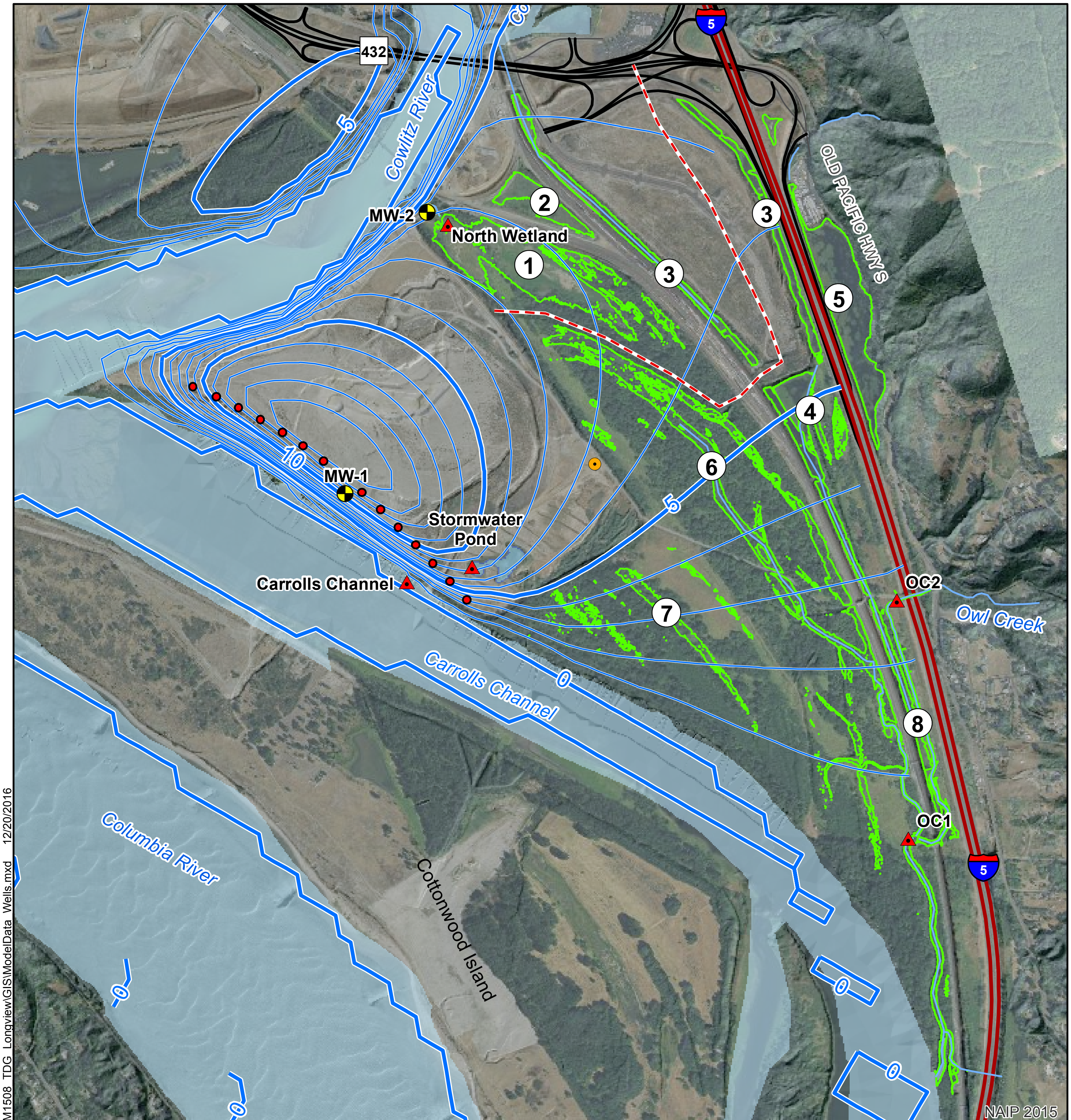

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- Modeled Vertical Wells
- Groundwater Monitoring Well
- Surface Water Monitoring Station
- Winters Well
- Modeled Drawdown Contours - Wells
- 4 Modeled Wetland Area
- Estimated Surface Water Divide

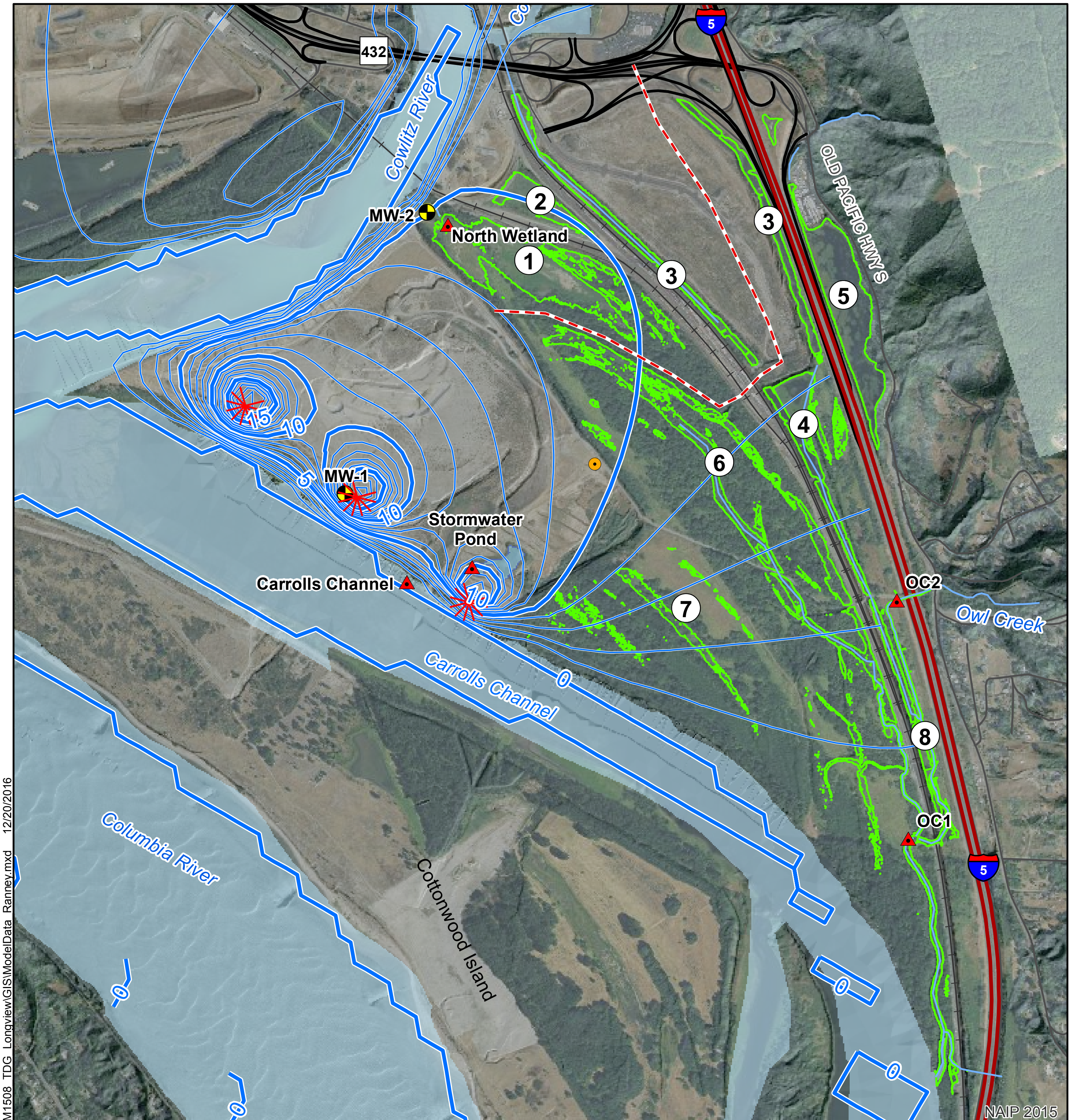
N

0 Feet 1,500

Figure 9

Modeled Drawdown with 30 mgd Produced From Vertical Wells

PGG



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Groundwater Monitoring Well

Surface Water Monitoring Station

Winters Well

Modeled Ranney Collectors

Modeled Drawdown Contours - Ranney

4 Modeled Wetland Area

Estimated Surface Water Divide

N

0 Feet 1,500

Figure 10

Modeled Drawdown with 30 mgd Produced From Ranney Collectors

PGG

Table 1. Estimates of Vertical Leakage through Modeled Wetlands and Flow Rate Required to Maintain Constant Heads

Modeled Wetland Area No. (Figure 2)	Wetland Cell Block Area in Model (ft^2)	Model Estimated Linear Vertical Leakage (ft/d)	Vertical Leakage Used in Flow Calculation (ft/d)	Total Modeled Wetland Area Estimate (ft^2) Note 1	Flow Rate Required to Maintain Constant Head in Modeled Wetland (gpm)
1	35,000	0.0126	0.0126	1,018,332	67
2	90,000	0.0097	0.0097	203,983	10
3	279,000	0.0070	0.0070	566,001	20
4	200,000	0.0059	0.0059	426,077	13
5	180,000	0.0060	0.0060	776,827	24
6	300,000	0.0061	0.0061	606,606	19
7	150,000	0.0045	0.0045	159,674	3.8
8 (Near OC2)	237,500	0.0030	0.0016	45,430	0.4
8 (Near OC1)	437,100	0.0003			

Total Estimated Flow Rate Required to Maintain Constant Heads in Modeled Wetland Areas 1-8 (gpm):	158

Notes:

[1] Areas for Wetlands 1-7 estimated from GIS; area for Wetland 8 estimated based on stream width observed during field investigations October 6, 2016 and length estimated from Google Earth bewteen Carrolls Channel and bedrock upland.

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