



Technical Memorandum

Date: Monday, October 25, 2021

Project: City of Puyallup Knutson Farms Environmental Impact Statement

To: Chris Beale, City of Puyallup

From: Paul Weber, HDR

Subject: Rail Mitigation Analysis – Rail Concepts Memo.v2

Introduction

The City of Puyallup has requested the services of HDR to analyze the feasibility of providing rail access to the Knutson Farms Industrial Park (Park) as a means of mitigating potential roadway traffic impacts. Additionally, if rail access into the Park was determined to be feasible, then HDR would incorporate rail as a potential mitigation measure into the project's Draft Environmental Impact Statement (DEIS), including an analysis of impacts rail would have.

HDR was tasked with looking at three potential Rail Options: one connecting to the BNSF (which parallels the site on the north side), and two connecting to the Meeker Southern shortline (which runs just to the south of the site).

Key assumptions include:

- Design for Concepts will be based primarily on the BNSF Design Guidelines for Industrial Track Projects (DGFITP).
- Concepts will not include development of exact profiles, but will consider grade constraints/limitations.
- Concepts are based on Manifest / Carload type traffic / service by the Meeker Southern and BNSF (not unit trains, intermodal, or other specialty service.) Typical BNSF service practices indicated BNSF would be resistant to offering intermodal service at this type of industrial development.

For reader understanding, here are some definitions of commonly used terms throughout this memo:

- Manifest / Carload Traffic – A single or numerous car(s) carrying a shipment of a single shipper from origin to destination that is moved with other cars of a different shipper and likely different origins and destinations.
- Intermodal – for the purposes of this memo, Intermodal would be considered containers or semi-trailers that are shipped via train for at least part of their journey and in dedicated intermodal trains between intermodal hubs.
- Manifest Train – A train made up of Manifest / Carload type traffic with cars from various shippers and potentially many different origins and destinations. Often, these types of trains have many different types of rail cars in them. This is distinctly different than a unit train which has all cars from a single shipper and from a single origin to a single destination and usually using identical types of railcars. (This is similar to a typical UPS or Fedex truck which will

have multiple packages for different shippers and from different origins and for different destinations.)

- Turnout Size. The number of a turnout describes the angle of divergence, as a ratio, at the frog of the turnout. The frog is part of the turnout that provides for one rail to cross though the opposite rail as they diverge / separate. Turnouts range from #7 all the way to #20 and higher. Higher the number the lower angle of divergence, the longer the turnout, and the higher the speeds allowed though the diverging side. The standard minimum size for industrial track is #9 for modern heavy equipment making slow movements.
- Unit Train – A train in which all of the rail cars carry the same commodity from a single origin to the same destination for the same shipper.

Initial Concept Analysis

HDR was asked to look at three specific options as described below:

- BNSF Concept - Connection from the Park directly to the BNSF mainline to the west of the site.
- Meeker Southern Concept #1 - Connection from the Park to the Meeker Southern line south of the site.
- Meeker Southern Concept #2 - Connection from the Park to the Meeker Southern line west of the site.

The basis for the concept designs is the BNSF DGFITP. It is assumed that the Meeker Southern would accept BNSF DGFITP. An industrial park like Knutson Farms falls into the category of standard (non-unit train) Industrial Trackage, which involves somewhat less stringent geometry requirements for railroad track construction than a unit train facility.

The relevant BNSF DGFITP requirements that most directly impact the development of the rail concepts are as follows:

- Curvature: Maximum degree of curve = $9^{\circ}30'$ (equivalent to minimum radius of 603.81 feet).
- Minimum tangent length of 50 feet between reversing curves (curves turning in opposite directions).
- Mainline turnouts must be placed a minimum of 200 feet from the end of a mainline curve.
- Industry turnouts within facility must be placed a minimum of 50 feet from the end of any curve.
- Profile Grade: Maximum of 1.5% on any tracks.
- Turnouts:
 - #11 minimum for mainline connecting turnout
 - #9 minimum for any turnouts within facility
- Derail: Double Switch Point type protecting mainline connection; must be placed a minimum of 100 feet beyond clear point.

HDR's goal with each concept was to adhere to the BNSF DGFITP (where applicable), American Railway Engineering and Maintenance-of-Way Association (AREMA), and other commonly accepted industrial rail engineering standards, while also minimizing impacts to the current concept plan for the Park, including the proposed footprints of warehouses / buildings. It was assumed that the long strips along each building that appeared to be a loading dock would be the preferred side of the buildings to have rail access as opposed to the sides that appeared to be more like offices. Impacts to roadways were avoided to the extent possible, although, in some cases the limited space between buildings made it necessary to locate tracks within roadways while also attempting



to minimize impacts to the proposed parking lots where avoidable. It is not uncommon to combine trackage and roadways in industrial complexes, if not otherwise avoidable.

Below is a description of the process used to develop each of the three rail concepts.

BNSF Connection Concept Analysis

The close proximity of an existing signalized “universal crossover” (turnouts allowing cross-over movements between two parallel main tracks) on BNSF’s mainline and generally more strict track geometry requirements were the two primary constraints on the development of the BNSF connection concept. In particular, the DGFITP maximum degree of curve requirement results in very limited potential for rail access from a BNSF connection. Without a significant re-design of the overall layout of the Park, including modifying buildings sizes and shapes, expansion of roadway corridors between buildings, etc., it was determined that only the northernmost three buildings in the Park could be accessed from the BNSF connection. Providing rail access to warehouses in the central or southern parts of the Park would require sub-standard curves and/or major changes to the overall layout of the Park. This concept is referred to as BNSF Connection Concept and is shown in an exhibit as an attachment to this memo.

While it is possible for BNSF to grant design exemptions for requirements in the DGFITP, this is normally only provided in extreme cases where the exemption is unavoidable – for example, when existing conditions, structures, property constraints, etc. provide no alternative option or when BNSF would not be directly providing the rail service.

HDR placed the #11 mainline connecting turnout near the northwest corner of the Knutson Farms property, just east of a long curve in the BNSF mainline. This was determined to be the most feasible location for the connecting turnout in order to minimize the impacts to BNSF’s existing infrastructure and signal system. (BNSF has an existing universal crossover with signals just a few hundred feet northeast of this location). Even so, there is risk that BNSF would not embrace this turnout location due to its proximity to that crossover due to signal apparatus / equipment that may be desired / required, signal indication, and related geometric limitations.

The BNSF concept utilized maximum degree of curve of 9°30’ to provide rail access to Buildings A, B, and C in the north end of the Park. A 50-foot tangent was placed a short distance past the mainline turnout to provide sufficient room for a double switch point derail at the required location per the DGFITP. Also provided was a short run-around siding within the facility; this would likely be required by the BNSF so that the Park could be served by a local train traveling in either direction on the BNSF mainline. The length of this run-around was limited by the width of the Park site. Also note that if BNSF’s local were to serve the site while traveling northbound (from Tacoma towards Seattle), the length of this run-around would be a significant limiting factor on the total number of cars that could be switched at one time.

While discussion with the railroads was not provided in the scope of this project, previous experience has shown that BNSF would likely require a mainline connection of this nature to be signalized, significantly adding to the cost, complexity, and timeline of the rail design. It is somewhat uncertain whether BNSF would require a fully powered CTC turnout and all accompanying signals, or just a “leaving signal”. This option would not require any additional property acquisition as the BNSF right-of-way is adjacent to the Knutson Farms property.



Meeker Southern Concept #1 (#1A and #1B) Analysis

The Meeker Southern does not have their own guidelines for industrial track construction, so HDR proceeded with the initial assumption that the Meeker Southern would prefer to have any new industrial trackage constructed in adherence with BNSF's DGFITP, to the extent possible.

Initially, HDR looked at a concept that would reach all proposed buildings except Building A. This concept required the use of 15-degree curves to reach some sides of some of the buildings, which would not meet BNSF's DGFITP requirement for maximum degree of curve. This concept used a south-to-north running lead either running in the middle of or adjacent to 134th Avenue. Unless the buildings could be re-configured (rotated 90 degrees "schematically") to have their loading areas on the west and east sides of the warehouses, then this option would potentially allow rail access to Warehouses B, C, and D without requiring curvature in excess of 9°30'. However, in the current apparent building arrangement, each spur would require 15° curves in order to reach the docks along the north and/or south sides of the warehouses. Access to the warehouses in the southeast portion of the Park would be possible only with minor property acquisition in the northwest quadrant of the Van Lierop Nursery, or by significant reconfiguration of the warehouse layout to allow trackage to stay within the limits of the Park. This concept would require obtaining private property or an easement through these properties: Parcels 0420264023, 0420264019, 0420264007, 0420264018, 0420268014 and 0420268013. This concept is referred to as Meeker Southern Concept #1A and is shown in an exhibit as an attachment to this memo.

Concept #1A was not carried forward for additional analysis as a second option (1b) is preferred which offers an easier pathway to the Meeker Southern line through a public parcel (County parks land) as opposed to the private parcels that would be required under #1A. After some discussion with the City, HDR determined that without requiring major modifications to the currently proposed building layouts, the only viable route for the lead track to enter the south side of the Park would be to use a 15° curve on the lead track and come north from the Meeker Southern main track on the corridor between Buildings F and G. HDR found that by continuing to employ the use of 15 degree curves, rail access to every warehouse in the Park, (including Building A, appears feasible on a conceptual level with this variation. This concept is referred to as Meeker Southern Concept #1B and is shown in an exhibit as an attachment to this memo.

Regarding using 15-degree curves: While this poses some risk, HDR believes it is likely that the Meeker Southern would find this degree of curvature acceptable, especially considering that the Meeker Southern already operates over industrial track curvature at least as tight as what we have proposed – including an existing industrial spur just south of the Knutson Farms site that was constructed approximately 10 years ago. While curvature of this nature does not pose any inherent danger to most conventional rail equipment, it can negatively affect operations. Examples of this include higher train forces which can lead to derailments if trains are not handled with care and trains are not limited in length. Making couplings and uncoupling can be difficult on sharper curves, and long / short car combinations can lead to excessive train forces and derailments if not considered and eliminated by crews. It should be noted that such high degree of curvature will increase track maintenance expenses in these areas.

Meeker Southern Concept #2 Analysis

HDR briefly looked at the feasibility of a connection to the Meeker Southern along the geographic west side of the site, but due to a number of existing physical constraints, such as the embankment



and overpass for Shaw Road SE, several large utility poles near that overpass over the BNSF mainline, and uncertainty of the ability to acquire property or right-of-way to construct track parallel to the BNSF mainline for an extended distance, this option was deemed to be impractical and not worth pursuing. No exhibit was developed for this potential concept.

Summary of Connection Concepts

Assumptions	Meeker Southern Connections		BNSF Connection Concept
	Concept 1A	Concept 1B	
Warehouse Access	All warehouse except for Warehouse A would be accessible by the rail line.	All warehouses would be accessible by the rail line.	Warehouses A, B, and C would be accessible by the rail line.
Curvature	15 degrees in some locations, which is outside of BNSF DGFITP requirements for maximum degree on curves.	15 degrees in some locations, which is outside of BNSF DGFITP requirements for maximum degree on curves.	9°30', which meets the BNSF DGFITP requirements for maximum degree on curves.
Property Acquisition or Easement Requirements	This concept would require obtaining private property or an easement through these properties: Parcels 0420264023, 0420264019, 0420264007, 0420264018, 0420268014 and 0420268013	Requires an easement through Pierce County Parks land to the south of the proposed project.	No property acquisition or easement would be required.

Selection of Recommended Concept

After some discussion, HDR and the City jointly decided that the most feasible rail concept to proceed with for purposes of inclusion on the EIS would be the Meeker Southern Concept #1B that would potentially provide rail access to every proposed warehouse in the Park. This option assumes all rail service in the Park would be performed by Meeker Southern, with no direct service into the Park from BNSF. The final concept meets the following criteria:

- Maximum curvature on Lead Tracks: 15°
- Maximum curvature on Industry Spur Tracks: 15°
- Minimum Turnout Size: #9
- Minimum Tangent Length between reverse curves: 50'

Operations

It is assumed that Meeker Southern would perform switching operations with their locomotive/locomotives on the west end of the train (as we have assumed is the case for their current operations). Due to constraints, some spur tracks had to be configured to be switched from the opposite end of a cut of cars (specifically the spurs that serve Buildings F and G). A short run-around track has been provided to facilitate a locomotive running around to the opposite end of a cut of cars in order to switch these two spur tracks.

The trackage provided within the Park is the minimum necessary to be able to serve the facility. Other than the run-around track to support Buildings F and G and a short tail track at the end of the lead between Buildings A and B, no internal switching or storage tracks are provided in this concept. If a large number of cars (more than approximately 15-20 cars) were being switched at one time, it is likely that Meeker Southern would need to leave “inbound” cars on their main track east of the Park connecting turnout, enter the facility with just the locomotive and gather all outbound cars, then pull all outbound cars out of the Park, couple to the inbound cars, and then spot all inbound cars into the respective spur tracks. On the other hand, if a relatively small number of cars was being brought in or out of the Park, it may be possible for the train to bring inbound cars into the Park at the start of switching and move these cars around the facility throughout the switching operations. As is typical of industrial parks like this, the railroad crew would be responsible for keeping track of the number of cars being picked up and dropped off and planning accordingly.

Note that if a fairly large number of cars were being switched at one time, the train could become long enough to simultaneously block multiple crossings during switching operations. Significant reconfiguration of the roads in the current Concept may be desired to reduce the number of potentially blocked grade crossings within the Park during switching operations and attempt to mitigate the number of cases where vehicular traffic would be “trapped”. This may require providing alternate access routes to some buildings.

Theoretical Rail Throughput

The theoretical maximum rail throughput of the facility is highly dependent on the frequency and of BNSF performing interchange with the Meeker Southern. It appears that the current interchange operations are performed using an Auxiliary track that parallels the BNSF mainline that is connected to the BNSF on the west end only. The Meeker Southern Main Track connects to this Auxiliary Track near the west end of this track; a few hundred feet east of the BNSF Main Track connection. This Auxiliary track provides two functions:

1. To hold the cars to be interchanged between the railroads. This takes place on the easterly portion of the Auxiliary track, which we will now refer to as the Interchange Track.
2. Provide switching head room / pull back capacity for Meeker Southern to move / switch cars between the Meeker Southern Main Track and the Interchange track.

The existing Interchange track has a clear capacity of approx. 1,370 TF (track feet). Using an average coupled railcar length of 60 feet, this track can hold a maximum of 22 railcars. Complicating the interchange process is the fact that the head room for Meeker Southern to be able move cars from the interchange track to the Meeker Southern Main Track is only approx. 410 TF (point of switch to derail). With a single typical road switching locomotive that is 65 feet long, only approximately five railcars can be moved from the Meeker Southern Main Track over to the Interchange track in each move. Any more than five cars would take multiple moves. There is also



no nearby runaround track on the Meeker Southern. (As stated above, we assume that currently all Meeker Southern operations take place with the locomotive on the west end of rail cars.) These means that with a relatively large volume of railcars, interchange would be a very time consuming and inefficient process for the Meeker Southern without expanding the existing interchange's capacity, but, while inefficient, it is possible.

It was not within the scope of this task for HDR to contact either of the two railroads for confirmation of current interchange frequency, but it is likely that BNSF's local train only interchanges with Meeker Southern once or twice per week, and there is no guarantee of BNSF necessarily increasing their service frequency.

If hypothetically BNSF were to increase their service frequency to five days per week (a fairly typical frequency for a local job serving a relatively busy corridor), then the existing design for the Interchange track would limit Knutson Farms' rail service to 22 cars per day (the capacity of the Interchange track) or 110 cars per week. Knutson Farms' maximum throughput would likely be slightly less than that, as the Meeker Southern also has a few other industries that depend on the interchange – although from the limited information available to HDR including Google Earth satellite imagery and online videos, it appears these existing / current customers likely only ship a handful of cars per week.

In order to achieve any higher rail throughput for the Knutson Farms Industrial Park, the existing interchange trackage would need to be significantly expanded.

The table below is a summary of the railcar capacity (unloading spots) of each spur at the nine warehouse buildings in the Park.

Warehouse	Capacity at Dock (TF)	60-Foot Cars
A	585	9
B	600	10
C	560	9
D	615	10
E	452	7
F	293	4
G	361	6
	Total 60-Foot Cars:	55

If all spur tracks were occupied to the maximum capacity with railcars, there would be a total of 55 railcars at 60 feet long each. It appears likely that there is physical room to extend the existing Interchange track to the northeast parallel to the BNSF main to reach this 55-car capacity. The Interchange track could potentially be tied back into the BNSF mainline with a turnout just southwest of the existing BNSF signalized universal crossover, allowing the interchange to be served by the BNSF from either direction (Figure 1). In order to reduce the number of switching

moves for the Meeker Southern, the current “pull-back” capacity of the Auxiliary track west of the Interchange track could be extended by adding a turnout to the Auxiliary Track just to the west of the current Meeker Southern Main Track and extending a new track to the west towards 15th Street SE. The clear length of the resultant new stub-ended pull-back track would be approximately 1400-1500 feet long to avoid going beyond the 15th Street SE grade crossing. This track arrangement would still require the Meeker Southern to make several moves to perform the interchange operations when handling a large number of cars, but many fewer moves than with the current arrangement.

If there was a desire to be able to handle more than 55 railcars per day in and out of the Park, this would require significantly more interchange track (including possibly multiple parallel siding tracks, which may not be feasible given property limitations, existing utility poles, existing bridge supports and/or clearance issues at the Shaw Road SE overpass, etc.), and Meeker Southern performing two switches at every warehouse every day. It is extremely unlikely that BNSF would provide local service more than once per day, but with two switches per day, that increases the theoretical rail capacity of the Park to 110 cars per day. Again, it is uncertain how feasible an interchange track arrangement with 110 cars of capacity would be.

If the BNSF was willing to perform interchange twice a day after suggested modifications at the interchange were completed, then the maximum daily throughput for the Park would be 110 cars or approximately 275 to 330 truckload equivalents. We believe that two switches per day is the maximum number of switches per day that would be possible considering the time it would take to perform interchange and switch the facility.

Note also that our single idea of expanding the interchange is only one idea. Another such idea includes construction of an auxiliary track parallel to the Meeker Southern Main line that would be located generally between 23rd Street SE and 13th Avenue E (Figure 1). This arrangement would allow roughly between 27 and 36 cars to be interchanged between Meeker Southern and BNSF. However, the blocks of cars would have to be “cut” for numerous grade crossings and this activity would have a significant impact on traffic on Shaw Road while this operation was taking place. The variable range of interchange capacity above (27-36 cars) attempts to recognize the fact that it is not exactly known if the private crossings would get treated with the most restrictive setback requirements during every single interchange event. The track could also be used to perform a run around move for either railroad but that would again have significant impact to traffic on Shaw Road. We don't believe this option (track parallel to Pioneer) provides as much capacity as the previously suggested version next to the BNSF main track. The option adjacent to the BNSF main track certainly avoids most impacts to traffic on Shaw Road and other roadways crossing the Meeker Southern. Note that the railroads will typically not agree to limiting their ability to serve to certain times of the day. There are many other potential track arrangements for the interchange to be considered, and the other options we can envision may be required by the BNSF for them to agree to providing daily or twice-daily service.

We also don't believe the maximum potential throughput of rail volume is dictated by the interchange configuration. It's mostly a function of Park tenants loading or unloading cars, and the Meeker Southern performing the switching. We want to emphasize that the 110 cars per day with two switches a day should be viewed as a potential unlikely extreme maximum.

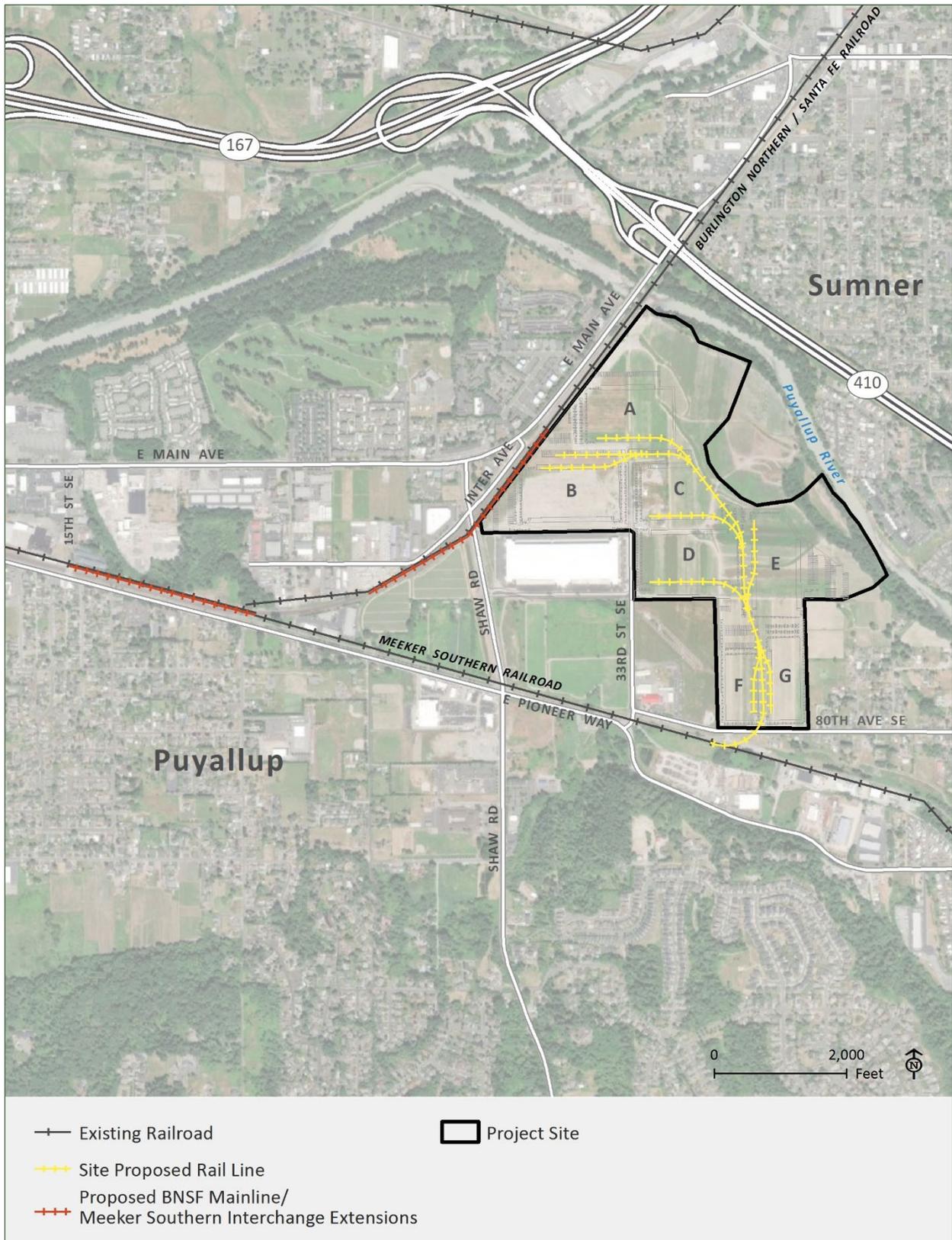


Figure 1. Proposed rail line and Interchange Extensions



Conclusion

For the purposes of rail as a mitigation measure for reducing truck traffic on nearby roads, HDR's opinion is that the highest practical maximum rail throughput of the Park per Concept #1B is 110 railcars per day. That level of throughput is highly dependent on Meeker Southern switching the Park at least twice daily, the construction of significant additional trackage at the interchange between Meeker Southern and BNSF and an increase in BNSF's current interchange frequency to twice daily.

In practical terms, it is likely that throughput from the Park would increase very gradually and likely never approach the theoretical maximum. For that reason, a phased approach to the interchange expansion and increase in BNSF service is likely more feasible to avoid constructing an interchange that will be vastly underutilized for many months or years. Meeker Southern's current interchange arrangement may be inefficient, but for relatively small carloadings, including some from Knutson Farms, it may still be workable in the short term until larger carloadings develop at the Park.

BNSF CONNECTION CONCEPT EXHIBIT

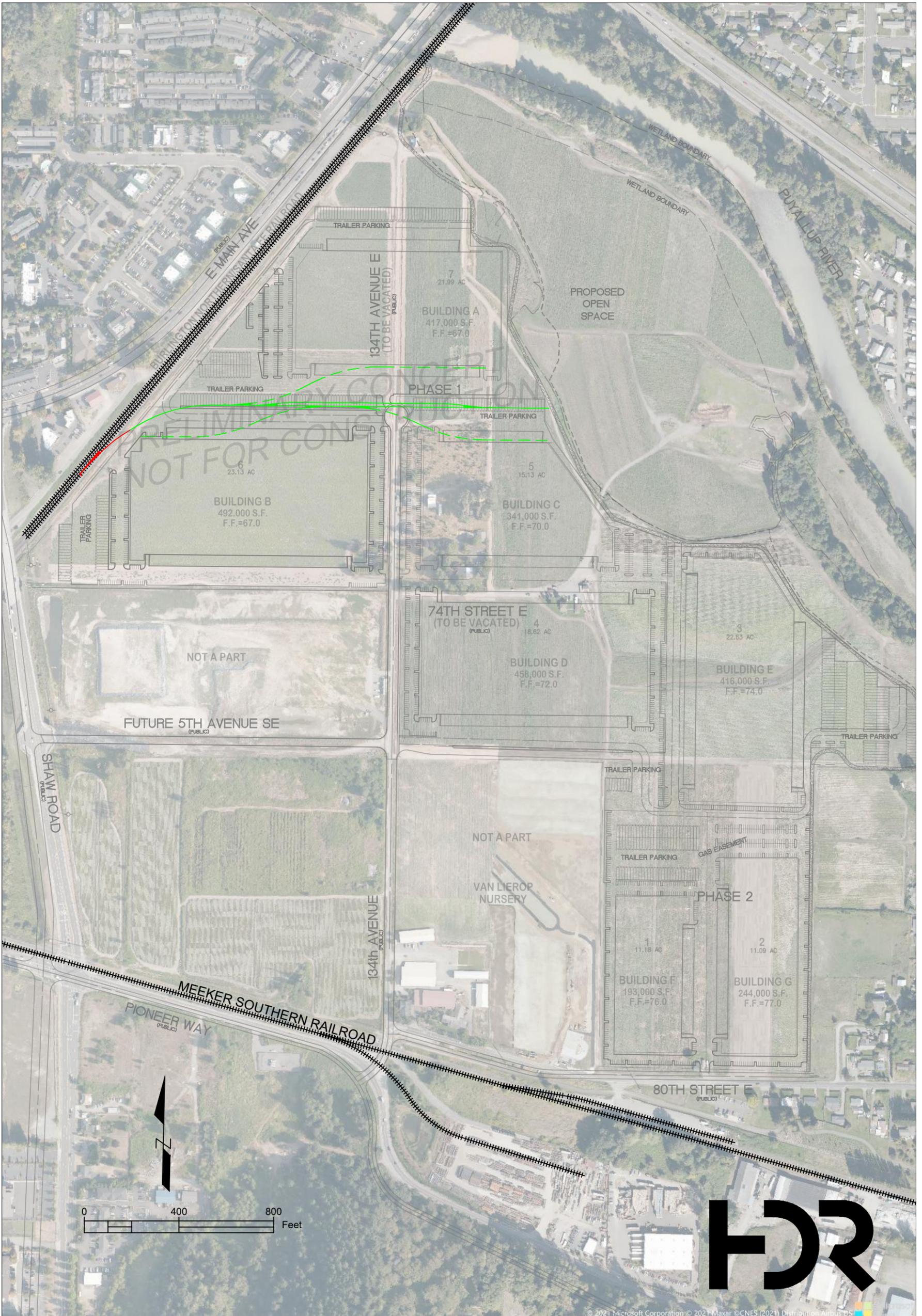
KNUTSON FARMS INDUSTRIAL PARK CONCEPT RAIL LAYOUT

PUYALLUP, WA

10/5/2021

LEGEND

- +++++ EXISTING TRACK
- PROPOSED BNSF-OWNED LEAD TRACK
- INDUSTRY-OWNED LEAD TRACK (9°30' MAX. CURVES)
- - - INDUSTRY-OWNED INDUSTRY SPUR TRACK (9°30' MAX. CURVES)



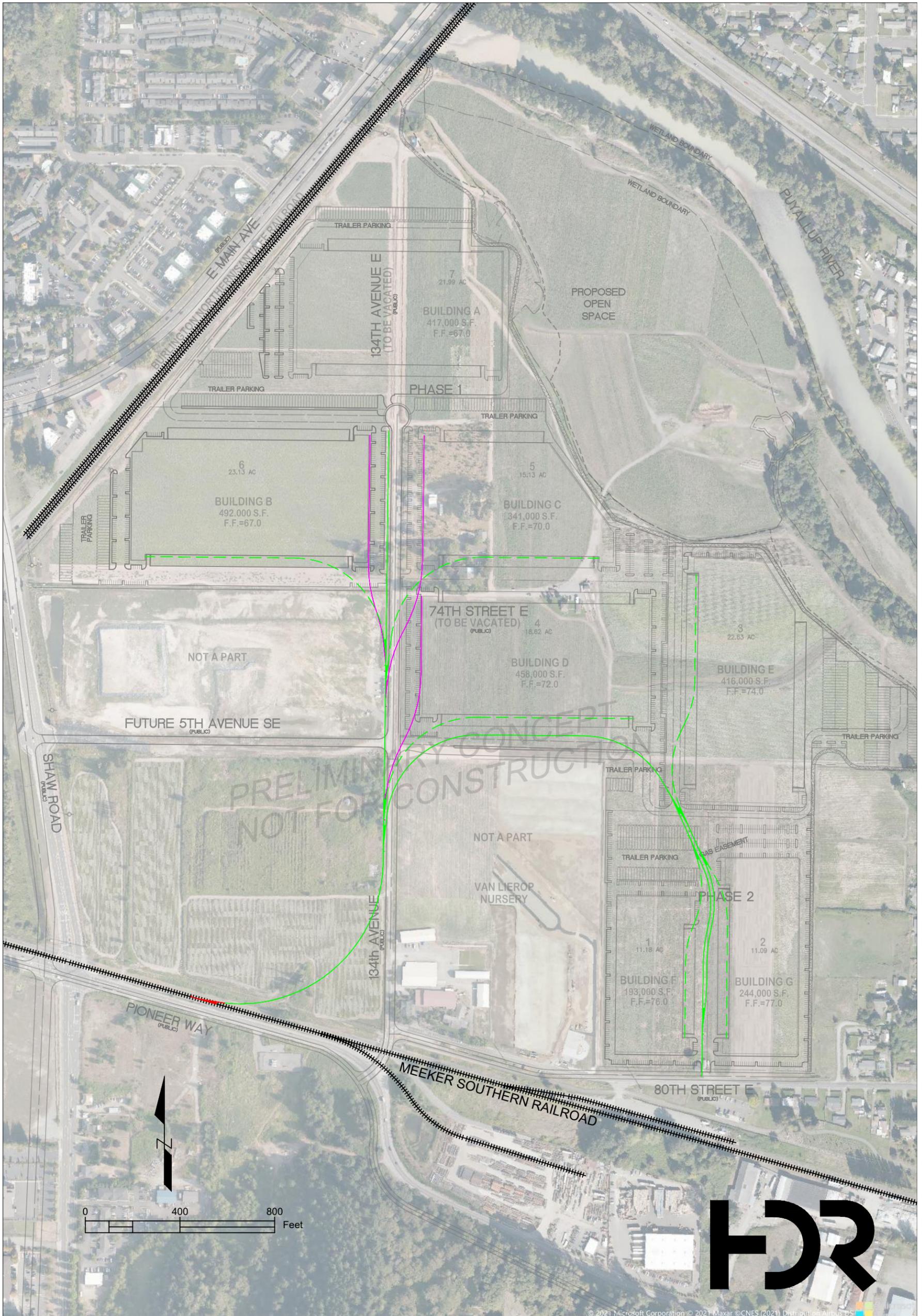
MEEKER SOUTHER CONCEPT #1A

KNUTSON FARMS INDUSTRIAL PARK CONCEPTUAL RAIL LAYOUT

PUYALLUP, WA 10/5/2021

LEGEND

- +++++ EXISTING TRACK
- PROPOSED MEEKER SOUTHERN-OWNED TRACK
- INDUSTRY-OWNED LEAD TRACK (9°30' MAX CURVES)
- - - INDUSTRY-OWNED INDUSTRY SPUR TRACK (15° MAX. CURVES)
- ALTERNATE INDUSTRY-OWNED INDUSTRY SPUR TRACK (9°30' MAX CURVES)



MEEKER SOUTHERN CONCEPT #1B EXHIBIT

KNUTSON FARMS INDUSTRIAL PARK CONCEPT RAIL LAYOUT

PUYALLUP, WA

10/5/2021

LEGEND

- +++++ EXISTING TRACK
- PROPOSED MEEKER SOUTHERN-OWNED TRACK
- INDUSTRY-OWNED LEAD TRACK (15° MAX. CURVES)
- - - INDUSTRY-OWNED INDUSTRY SPUR TRACK (15° MAX. CURVES)

