

APPENDIX L

Sewer Flow Assessment

**Dorsey Marketplace Project
Technical Memorandum No. 1**

Sewer Capacity Assessment




Prepared for:
DUDEK

Prepared by:
Stantec Consulting Services, Inc.

October 21, 2016

DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

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DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Purpose
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TM1 Sewer Capacity Assessment

Prepared By: Breanna Webb, EIT

Reviewed By: Dave Price, PE

Date: October 21, 2016



1.0 PURPOSE

Stantec has completed a sewer capacity assessment to evaluate specific impacts of the proposed Dorsey Marketplace development on the City's existing wastewater collection system. The purpose of this memo is to present the results and findings of the sewer capacity assessment.

The R. Jeter Family Trust has proposed a development located at the southeast corner of Dorsey Drive and Highway 49 within the City of Grass Valley (City), known as the Dorsey Marketplace Project (Proposed Project). The development will have two entrances, one on Dorsey Drive and the other on Springhill Drive. The proposed utility plan routes wastewater by gravity through an 8" sewer collector in Springhill Drive which connects to an 18" trunk sewer in Idaho Maryland Road. The Idaho Maryland Trunk sewer connects to the City's Main Trunk sewer where Idaho Maryland Road intersects East Main Street. The Main Trunk is aligned roughly parallel to Highway 49 and conveys flow to the City's wastewater treatment plant (WWTP).

1.1 BACKGROUND

1.1.1 Dorsey Marketplace Project

The Proposed Project is of a 26.9 acre former mine site, located on the south side of Dorsey Drive just east of the northbound off ramp of State Route 20/49 within the City of Grass Valley. The Proposed Project location is shown in **Figure 1**. It will consist of an integrated mixed use, infill retail commercial and residential project. The parcel was rezoned to reflect 21.2 acres of Commercial and 5.7 acres of Residential Urban High Density land use. The Proposed Project, consists of approximately 181,900 square feet of retail, service, and community uses, as well as a 90-unit apartment complex.

The Proposed Project is currently completing the entitlement process, which includes preparation of a CEQA document which is to identify all potential impacts resulting from the development of the project and any mitigation measures proposed to reduce those impacts to a less than significant level.

This report was required by the City of Grass Valley to assess the impact of the Proposed Project on the City's collection system. In addition to this report, which is specific to the potential project impacts on the City's sewer collection system, Genesis Engineering has prepared an overall



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capacity evaluation of the Springhill Drive sewer collector, which was also required by the City. This evaluation can be found in **Exhibit A**.

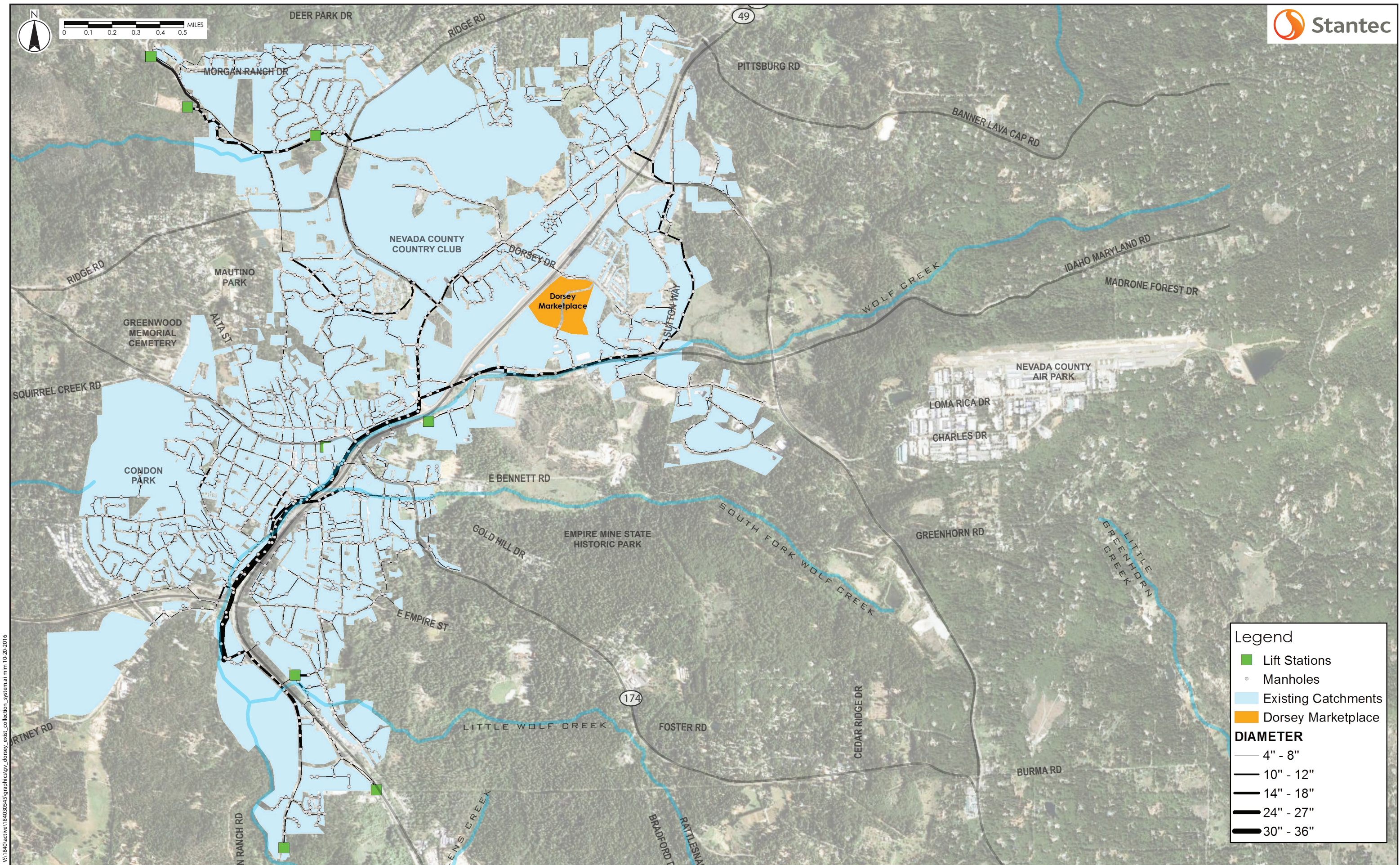
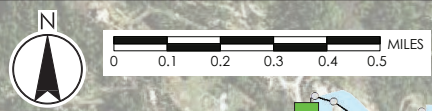
1.1.2 Wastewater System Master Plan

The City's Wastewater System Master Plan (Master Plan) was completed by Stantec in August of 2016. The Master Plan is intended to provide guidance to the City on the management of their existing WWTP, collection system and associated appurtenances by providing assessments of the existing collection system and WWTP condition and capacity, as well as options for providing additional capacity for planned future development. A skeletonized hydraulic model of the City's existing collection system trunk network was developed for use in the development of the Master Plan. This model was updated and used to provide a basis for the sewer capacity evaluation for the Proposed Project.

The Master Plan evaluated the following growth scenarios for the City:

- Existing
- Existing + Development of Vacant Parcels
- Near Term Development
- Long Term Development
- Build Out Growth

The future growth scenarios simulated for the Master Plan address serving build out of 1) the existing City service area, 2) the 2020 General Plan Spheres of Influence, 3) Special Development Areas and 4) Areas of Concern also identified in the General Plan. The projected growth areas are shown in **Figure 2**. The future flow projections were based on current general plan land use information and unit factors for flow developed and presented in the Master Plan. Peak wet weather flows (PWWF) were projected using the hydraulic model with a 10-year 24-hour design storm and were used to assess potential impacts to the City's collection system, for the five (5) growth scenarios identified above.



Legend

- Lift Stations
- Manholes
- Existing Catchments
- Dorsey Marketplace

DIAMETER

- 4" - 8"
- 10" - 12"
- 14" - 18"
- 24" - 27"
- 30" - 36"

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2.0 PROJECT CHARACTERISTICS

2.1 PROJECT LOCATION

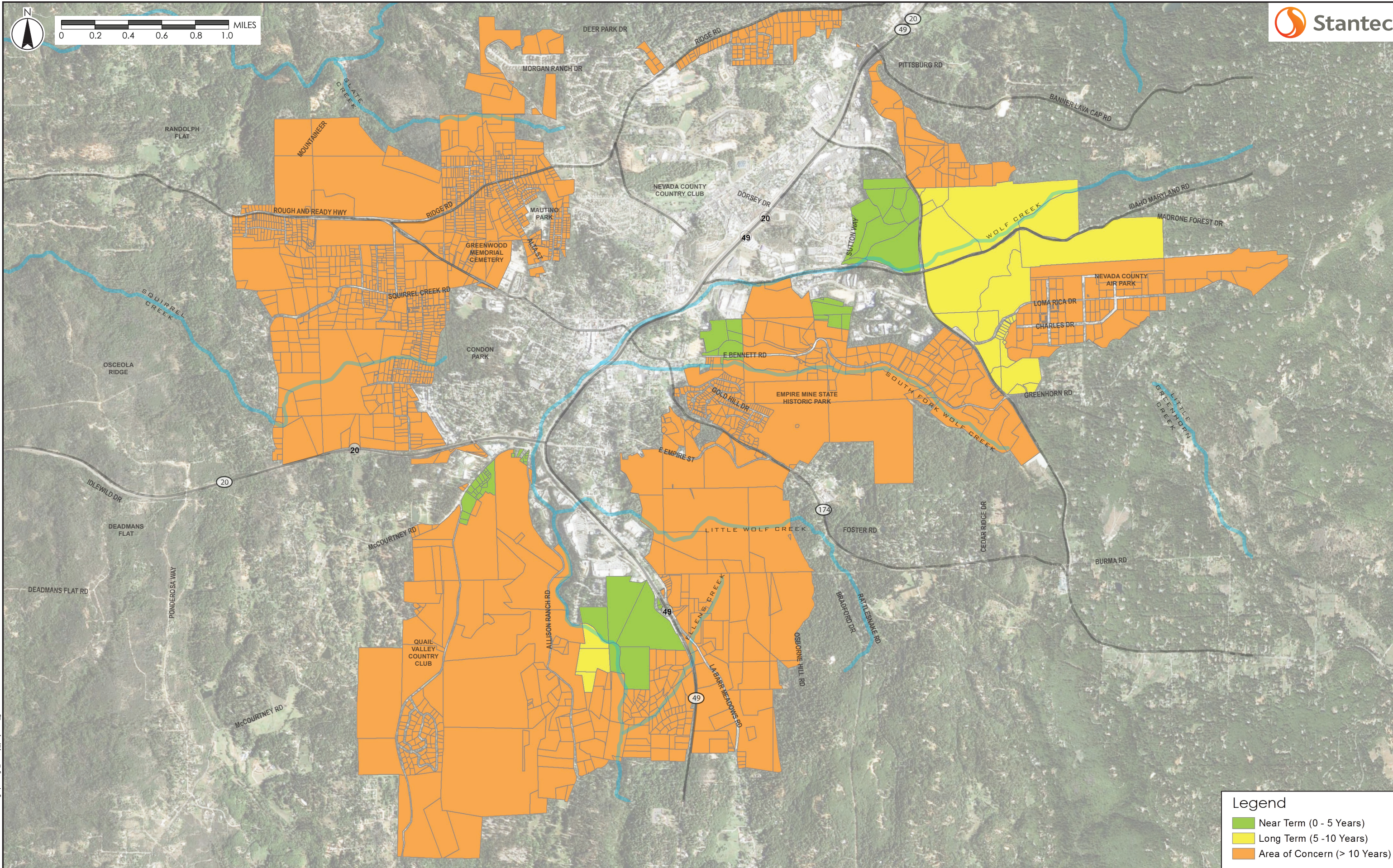
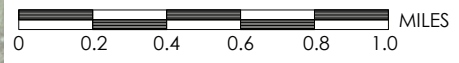
The study area is defined as the wastewater subcatchments that contribute flows to the WWTP serviced by the Idaho Maryland trunk. **Figure 1** shows the location of the proposed Dorsey Marketplace development in relation to the City's wastewater collection system. The Proposed Project is located east of Highway 49 on a vacant parcel within the existing sewershed.

The portion of the service area that discharged into the Idaho Maryland trunk covers an area of approximately 700 acres. The wastewater generated by these users is collected and conveyed to the City's WWTP via a network of gravity trunk mains, force mains and lift stations. The Idaho Maryland trunk generally follows Idaho Maryland Road west from Sutton Way across Highway 49 to E. Main Street, where it merges with the E. Main Street trunk sewer. The Idaho Maryland trunk collects flows from the northeast portion of the City, which includes commercial, industrial, and residential developments. To account for the foothill terrain in the service area, lift stations convey flow from lower areas to system gravity collectors.

2.2 FUTURE WASTEWATER FLOWS

The flow projections for the Proposed Project used in this analysis were provided by Genesis Engineering based on the City of Grass Valley Engineering Standards (Design Standards) and can be found in **Exhibit A**. Based on calculations from Genesis Engineering the developable site consists of 26.42 acres, 22.59 acres will be used for commercial design and the remaining 4.15 acres will be multi-family residential with 90 dwelling units (EDUs). The City Design Standards present wastewater generation rates of 850 gpd/acre for commercial development and 135 gpd for each high density residential dwelling unit, resulting in a total average dry weather flow (ADWF) of 31,352 gpd from the Proposed Project. The Design Standards also call for the use of a factor of safety of 2, and a peaking factor which varies relative to flow rate. Based on a factored ADWF of 0.063 MGD ($2 \times 31,352$ gpd, rounded), the peaking factor used was 4.8. The resulting total peak flow was estimated to be 0.301 MGD.

These projections are reasonable, and the peaking factor and safety factor correspond to a total peaking factor close to those seen in inflow and infiltration (I/I) investigations presented in the Master Plan. The peak flow was added to the model as a steady state inflow, meaning there is no additional I/I added (as there would be if it was entered as an ADWF).



Legend

- Near Term (0 - 5 Years)
- Long Term (5 -10 Years)
- Area of Concern (> 10 Years)



Hydraulic Model
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3.0 HYDRAULIC MODEL

A skeletonized hydraulic model of the City's existing collection system trunk network was developed as part of the City's Wastewater Master Plan. This model was used and updated to provide the basis for this sewer capacity evaluation. The wastewater collection system capacity was evaluated using a hydrodynamic routing software package, PCSWMM 2016 (SWMM5), by Computational Hydraulics Int. (CHI). This software package has been developed using the EPA SWMM 5.0 engine as its basis. The software has the ability to meet the following objectives:

- To determine the hydraulic capacity of the collection system and its components
- To identify system limitations such as bottlenecks and infrastructure incapable of accommodating future growth

3.1.1 Design Storms

Design storms are usually simulated in the hydraulic model to assess the capacity of the sewer system being studied under wet weather conditions. This is typically done with the goal of assessing potential risk of surcharging the system, which may result in sanitary sewer overflows (SSOs). A 1:10 year return period storm, with a 24-hour duration following the Huff design storm distribution was selected to assess system capacity under wet weather conditions with the addition of the Proposed Project. For reference the storm hyetograph is shown in **Figure 3**.

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Hydraulic Model
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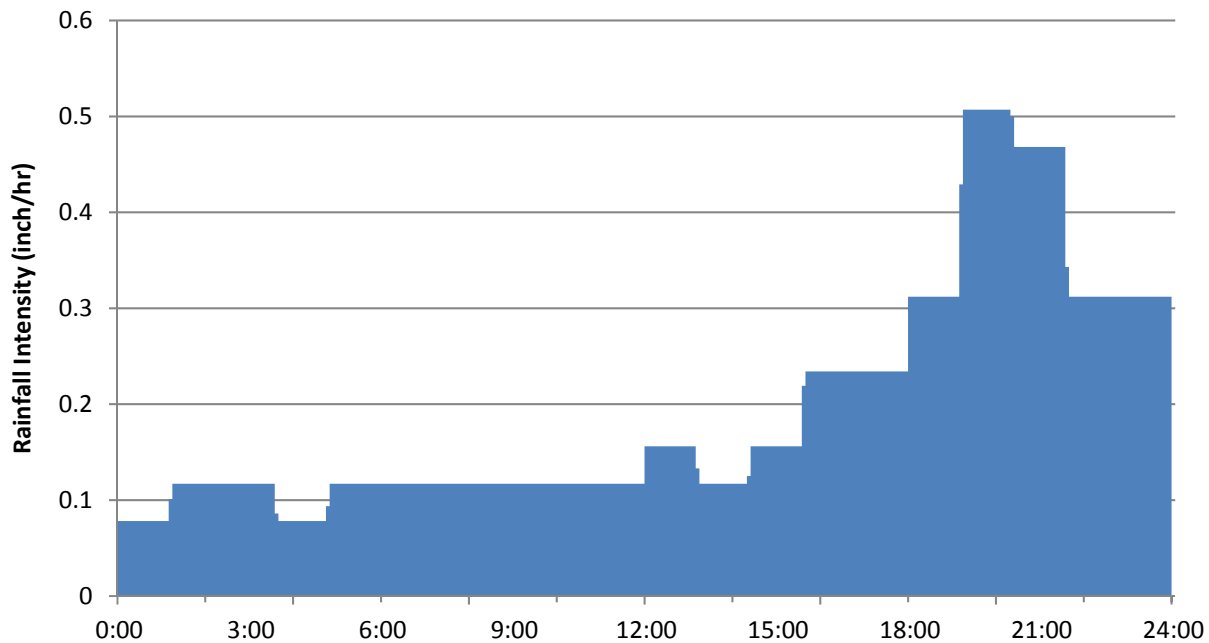


Figure 3 Rainfall Hyetograph for 1:10 Year, 24-hour Huff Design Rainfall

3.1.2 Model Updates

The Springhill Drive sewer collector was added to the model using elevation data provided by Genesis Engineering. The model developed for the Master Plan only features trunk sewers in the collection system greater than 12 inches in diameter. The survey provided by Genesis Engineering also included updated rim and invert elevations for manholes on Idaho Maryland Road from Springhill Drive to Railroad Avenue. These rim and invert elevations were updated in the Model. The manhole elevations gathered by Genesis Engineering as part of this analysis for the Proposed Project are presented in **Exhibit B**.

Flow from parcels along Springhill Drive was redistributed to respective manholes with the addition of the Springhill Drive sewer collector. The Springhill collector was not of sufficient size or overall system criticality to warrant its inclusion in the Master Plan trunk analysis.

All five scenarios presented in the Master Plan were updated and evaluated to include the changes due to the Dorsey Marketplace Project. A sixth scenario (Existing + Dorsey Marketplace) evaluating the existing system including the Proposed Project was also developed and simulated. The scenarios considered in this analysis include the following:

- Existing
- Existing + Dorsey Marketplace
- Existing + Development of Vacant Parcels + Dorsey Marketplace



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Sewer Capacity Assessment Criteria
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- Near Term Development + Dorsey Marketplace
- Long Term Development + Dorsey Marketplace
- Build Out Growth + Dorsey Marketplace

It should be noted that the parcels on which the Dorsey Marketplace project is proposed were included in the hydraulic analysis for the Master Plan. The scenarios above referencing "plus Dorsey Marketplace" differ from the Master Plan analysis in the projection of peak flow. In the Master Plan analysis, the parcels on which the Proposed Project is located were estimated to generate wastewater flows using unit factors presented in the Master Plan developed on a gallon per day per acre basis and using the City's General Plan land use designations assigned to those parcels. For this analysis the flows generated by the Proposed Project were based on estimates provided by Genesis Engineering, consistent with the City's Design Standards for system sizing and flow estimation.

4.0 SEWER CAPACITY ASSESSMENT CRITERIA

This section describes the criteria used to perform the sewer capacity assessment and evaluate the model results of the updated hydraulic model described in the sections above. The 1:10 year, 24-hour design rainfall event was applied to the PCSWMM Model after modifications had been made. The hydraulic model results were evaluated based on the City's level of service (LOS) performance criteria for the collection system, and are presented using various wastewater flow metrics to illustrate the capacity constraints of the system.

4.1 WASTEWATER FLOW METRICS

The results of the hydraulic model are assessed using four wastewater flow metrics:

- The peak flow at specific locations within each sewer under design storm conditions.
- The hydraulic surcharging at specific locations within each sewer under design storm conditions.
- Hydraulic loading ratio within each sewer under design storm conditions. Hydraulic loading ratios are commonly used as a metric to evaluate the performance of a collection system. The hydraulic loading ratio (HLR) is mathematically defined as the peak modeled flow divided by the full pipe capacity (calculated using Manning's equation), and is denoted "Max/Full Flow" in the results tab of the PCSWMM Sewer model.
- Residual capacity within each sewer when subjected to the peak flows of the design storm conditions. This result is the difference between full pipe capacity and the peak flow. This performance indicator is useful in illustrating the relative remaining capacity throughout the study area.



Model Results
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4.2 ALLOWABLE SURCHARGE CRITERIA

The City's LOS criteria for the collection system are based on the allowable surcharge within the gravity portion of the collection system. The maximum allowable surcharge in the gravity portion of the sanitary sewer system is assessed using the estimated hydraulic grade line (HGL) elevation of the fluid flow in the pipes. The HGL must remain at least 8 feet from the ground surface (i.e. at least 8 feet of freeboard required) during a design storm scenario. This is the criteria established by the City in the Master Plan analysis. Existing sewers with depths greater than 8 feet have been said to be within LOS criteria if the peak surcharge elevation results in a freeboard of greater than 8 feet with less than one (1) foot of HGL surcharging above the pipe crown. Any sewers identified with freeboard less than 8 feet are considered deficient should any surcharging above the pipe crown result. Thus, the identified deficiencies are generally based upon the criteria below:

- Minimum freeboard of 8 feet (HGL depth below rim)
- Surcharging less than 1 foot above pipe crown (with freeboard of 8 feet or greater)
- No Surcharging (with freeboard of less than 8 feet)

5.0 MODEL RESULTS

A summary of relevant model results from the Master Plan, as well as the results of the new scenarios assessed in this analysis are presented in the following sections. Results from the Master Plan, in the form of HGL profiles are shown in **Exhibit C**. HGL profiles 1 and 5, presented in the Master Plan, have specific relevance to the Dorsey Marketplace analysis.

To help identify the extent of surcharging within the existing network, profile figures from Dorsey Marketplace to the WWTP that show the peak HGL elevation along each profile section have been included in Exhibit D. The location of the HGL profiles can be identified by a plan-view key presented within **Exhibit D**. Note that these profiles include the results for each growth scenario. **Exhibit E** presents plan view figures for each scenario depicting minimum freeboard (depth below rim) in manholes and surcharging in pipes (whether or not they are deficient based on LOS criteria).

5.1 MASTER PLAN SUMMARY OF EXISTING CONDITIONS

The City's Master Plan identifies capacity issues within the City's existing collection system under design storm conditions. The HGL profiles in **Exhibit C** show the results of the capacity evaluation done as part of the City's Master Plan. The portions of the previous analysis that are specifically relevant to the Proposed Project include the assessment of the Idaho Maryland trunk, and the main trunk from its connection to the Idaho Maryland trunk to the WWTP. These results do not

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reflect the addition of the Springhill drive collector, the updated manhole elevations in the hydraulic model, or the updated flow generation estimates from the Proposed Project.

5.1.1 Idaho Maryland Trunk:

Master Plan HGL Profile 1, shown in **Figure C-1** of **Exhibit C**, presents HGLs for the Idaho Maryland trunk that extends along Idaho Maryland Road to the East Main Street trunk (Main trunk). Manholes in which the HGL did not meet LOS criteria were found in the Idaho Maryland trunk sewer upstream of the location where the Springhill Drive sewer collector discharges to the trunk. No surcharging was found to occur in the Idaho Maryland trunk downstream of the Springhill Drive sewer collector.

5.1.2 East Main Street Trunk:

Master Plan HGL Profile 5, shown in **Figure C-2** of **Exhibit C**, represents a section of the E. Main Street Trunk from the discharge of the City Hall Outfall to the WWTP. Very minor surcharging (<1 foot) was found to occur in manhole (MH) 117-7 (66 feet south of French Ave) as a result of the Master Plan analysis. This surcharging is a result of insufficient capacity in the twin 18-inch sewers crossing underneath Highway 20. There was predicted to be a minimum freeboard of greater than 20 feet under existing conditions, therefore still meeting LOS criteria. It was noted that this information for MH 117-7 was based upon a degree of upstream throttling due to capacity constraints, and this surcharging would likely worsen as those constraints are eliminated (i.e. flow is allowed to reach the twin 18-inch sewers at a higher rate).

5.2 EXISTING LEVEL OF DEVELOPMENT (EXISTING)

This scenario assesses the impact of the design storm on the existing wastewater collection system. These results include the model updates to the collector on Springhill Drive and the updated manhole elevations on Idaho Maryland Road, summarized in **Exhibit B**, but don't consider the additional flow from the Dorsey Marketplace development.

Very little difference in the model results are evident with the addition of the Springhill Drive sewer collector to the model construction when compared to those presented in the Master Plan, other than relative changes in HGLs caused by updated invert elevation. It is predicted that the WWTP will experience a peak flow of 13.5 MGD under design storm conditions. A plan view of model simulation results for the existing system during peak wastewater flow conditions are presented in **Figure E-1**.

The following provides a summary of surcharging in the existing system under design storm conditions and the corresponding peak HGL profiles which are presented in **Figures D-2** through **D-5**.

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5.2.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

There were no other significant differences within the results reported for this scenario and the existing scenario in the City's Master Plan in the Idaho Maryland Trunk. No surcharging was predicted to occur in manholes on Idaho Maryland Road under existing conditions. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.2.2 Main Trunk (from Idaho Maryland Road to WWTP):

MH 117-7, located on the Main Trunk, was predicted to be surcharged approximately 0.34 feet above the highest connected pipe crown; however, freeboard remained greater than 20 feet, therefore meeting LOS criteria. This surcharging is a result of limited capacity in twin 18" sewers crossing under Highway 20. This result is only slightly different from the results reported in the Master Plan. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.2.3 Springhill Drive (Dorsey Marketplace to Idaho Maryland Road):

The Springhill Drive collector was found to have excess capacity under the existing scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.2.4 LOS Deficiencies:

There are not expected to be any LOS failures under this scenario.

5.3 EXISTING + DORSEY MARKETPLACE DEVELOPMENT

This scenario assesses the impact of the design storm on the existing wastewater collection system with the addition of flows from the Proposed Project. For this scenario, it is predicted that the WWTP will experience a peak flow of 13.7 MGD. The inclusion of the Proposed Project is not predicted to cause any additional sewer segments to become surcharged; rather the additional loading will slightly increase the existing surcharging. A plan view of model simulation results relative to this scenario during peak wet weather flow conditions are shown in **Figure E-2**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to peak HGL profiles presented in **Figures D-2** through **D-5**:

5.3.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Under this design scenario there is expected to be no surcharging in this profile. The maximum predicted increase in the HGL for all of the sewers is 0.09 (MH N13-10) feet with the inclusion of the Dorsey Marketplace development relative to the "Existing" scenario. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.



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The most notable increase in HGL in the Idaho Maryland trunk was predicted in MH N13-10, the last manhole before the trunk meets the Main trunk at the intersection of Idaho Maryland Road and East Main Street, with an increase of approximately 0.09 feet.

The problems upstream of the Springhill Drive collector on Idaho Maryland trunk are not predicted to worsen with the addition of the Dorsey Marketplace development under this scenario.

5.3.2 Main Trunk (from Idaho Maryland Road to WWTP):

Model results predict there to be no additional sewers surcharged in this profile when compared to the previous scenario. The HGL of the surcharged sewer is expected to increase by a maximum of 0.28 feet (MH I17-7) with the inclusion of the Dorsey Marketplace development respective to the "Existing" scenario. The surcharged sewer still falls within the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.3.3 Springhill Drive:

There are not expected to be any sewers surcharged in this profile. The Springhill Drive sewer collector is predicted to have remaining capacity after the addition of the development. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.3.4 LOS Deficiencies:

There are not expected to be any LOS failures under this scenario.

5.4 EXISTING + DEVELOPMENT OF VACANT PARCELS + DORSEY MARKETPLACE

This scenario (Existing + Vacant + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of the remaining vacant parcels within the current City limits, including the addition of the Proposed Project.

It is predicted that under this scenario the WWTP would experience a peak wastewater flow of 15.2 MGD under design storm conditions with no capacity improvements made to the collection system. The inclusion of the vacant parcels, using the City's proposed land use designations, is predicted to cause some capacity constraints and deficiencies. A plan view of the model simulation results of this scenario during peak wastewater flow conditions are shown in **Figure E-3**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to peak HGL profiles presented in **Figures D-2** through **D-5**:

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5.4.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Minor surcharging (<1 foot) was predicted to occur in MH N13-10, the first manhole upstream of the connection between the Idaho Maryland Trunk and Main Trunk at the intersection of Idaho Maryland Road and East Main Street. Minimum freeboard is 9.25 feet and surcharge depth is predicted to be 0.88 feet, therefore meeting the City's LOS criteria. This surcharging is primarily due to a capacity constraint at the junction of the Idaho Maryland Trunk and the Main Trunk. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.4.2 Main Trunk (from Idaho Maryland Road to WWTP):

Model results predict there to be no additional sewers surcharged in this profile under the Existing plus Vacant Scenario. The HGL of the surcharged sewer may increase by 0.96 feet (MH I17-7) with the inclusion of vacant parcel development respective to the (Existing, + Dorsey Marketplace) scenario. The predicted surcharging in MH I17-7 is greater than 1 foot (1.59 feet) above the pipe crown and therefore no longer meets the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.4.3 Springhill Drive:

As there are no additional vacant parcels or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the previous scenario (Existing + Dorsey Marketplace). The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.4.4 LOS Deficiencies:

Due to a surcharge depth greater than 1 foot above the pipe crown, as shown in **Table 1**, manhole I17-7 fails to meet LOS criteria under the Existing + Vacant + Dorsey Marketplace scenario.

Table 1 LOS Deficiencies for Existing +Vacant + Dorsey

| MODELED RESULTS | |
|------------------------|-------|
| Manhole | I17-7 |
| Depth (feet) | 22.76 |
| Freeboard (feet) | 19.18 |
| Surcharge Depth (feet) | 1.59 |

5.5 NEAR TERM DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Near Term + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of areas identified within the Near Term development scenario as designated in the City's Master Plan. This scenario also includes the changes attributed to the Proposed Project. The Near Term growth scenario (~5-year) includes a portion of the "Loma Rica Special Development Area" (lands west of Brunswick Road, north of Idaho Maryland Road and east of Sutton Way), and a portion of the Berriman Ranch & Adjacent Property Area.

For this scenario, it is predicted that the WWTP will experience a peak flow of 16.5 MGD with no capacity improvements made to the existing collection system (with improvements to collection system capacity constraints, peak flows could increase). The inclusion of flow from Near Term developments is not predicted to cause any additional sewer segments to become surcharged under this scenario; rather the additional loading will cause the existing surcharging to worsen. A plan view of model simulation results are presented in **Figure E-4**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.5.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Model results predict there to be no additional sewers surcharged in this profile. The HGL of the surcharged sewer is predicted to increase with the inclusion of Near Term development respective to the (Existing + Vacant + Dorsey Marketplace) scenario. Minimum freeboard is 9.20 feet in surcharged manhole N13-10, and surcharge depth is predicted to be 0.93 feet, therefore meeting the City's LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.5.2 Main Trunk (from Idaho Maryland Road to WWTP):

There is predicted to be no additional sewers surcharged in this profile. The HGL of the surcharged sewer is estimated to increase by 0.73 feet (MH I17-7) with the inclusion of the Near Term development flows respective to the Existing + Vacant + Dorsey Marketplace scenario. The predicted surcharging in manhole I17-7 is greater than 1 foot (2.32 feet) above the pipe crown and therefore does not meet the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.5.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

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5.5.4 LOS Deficiencies:

Due to a surcharge depth greater than 1 foot as shown in **Table 2**, manhole I17-7 fails to meet LOS criteria under the Existing + Vacant + Dorsey Marketplace scenario.

Table 2 LOS Deficiencies for Near Term + Dorsey Marketplace

| MODELED RESULTS | |
|------------------------|-------|
| Manhole | I17-7 |
| Depth (feet) | 22.76 |
| Freeboard (feet) | 18.44 |
| Surcharge Depth (feet) | 2.32 |

5.6 LONG TERM DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Long Term + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of the areas identified within the Near Term and Long Term scenarios presented in the City's Master Plan. This scenario also includes the changes attributed to the Proposed Project. The Long Term growth scenario (~10-year) includes build out of the "Loma Rica Special Development Area".

Under this scenario, it is predicted that the WWTP will experience a peak flow of 17.2 MGD without capacity improvements made to the existing collection system. The inclusion of flow from Long Term developments is predicted to cause capacity constraints and deficiencies in both the Idaho Maryland and Main Trunk sewers. A plan view of model simulation results are presented in **Figure E-5**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.6.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Surcharging in manholes near the intersection of Idaho Maryland Road and East Main Street is predicted to worsen under the Long Term + Dorsey Marketplace scenario. MH N13-3 directly upstream of MH N13-10 is predicted to have a surcharge depth of 0.93 feet, and a minimum freeboard of 8.97 feet, which meets the City's LOS criteria. Surcharging in MH N13-10 is predicted to increase to a depth of 1.48, therefore failing to meet the LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.6.2 Main Trunk (from Idaho Maryland Road to WWTP):

Moderate surcharging is predicted to occur under the Long Term + Dorsey Marketplace scenario as a result of limited capacity in twin 18" sewers crossing Highway 20. The surcharge



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depth of MH 117-7 is expected to increase to 3.06 feet under this scenario, therefore failing to meet the LOS criteria. Minimum freeboard is predicted to be 17.71 feet, which is still well above the recommended value of 8 feet. Upstream manhole 117-3 is expected to surcharge to a depth of 1.27 feet, therefore failing to meet the City's LOS criteria, despite having a minimum freeboard of 13.41 feet. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.6.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.6.4 LOS Deficiencies:

The Manholes identified in **Table 3** fail to meet the LOS criteria under the Long Term + Dorsey Marketplace scenario.

Table 3 LOS Deficiencies for Long Term + Dorsey Marketplace

| MODELED RESULTS | | | |
|------------------------|-------|-------|--------|
| Manhole | 117-7 | 117-3 | N13-10 |
| Depth (feet) | 22.76 | 16.68 | 11.38 |
| Freeboard (feet) | 17.71 | 13.41 | 8.65 |
| Surcharge Depth (feet) | 3.06 | 1.27 | 1.49 |

5.7 BUILD OUT DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Build Out + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of remaining vacant parcels, the areas identified within the Near Term and Long Term Spheres of Influence, and Build Out of the Areas of Concern identified in the City's 2020 General Plan. This scenario also includes the changes attributed to the Proposed Project. The Build Out growth scenario includes all additional lands identified by the 2020 General Plan including the Special Development Areas of North Star Ranch, Kenny Ranch, the balance of the Berriman Ranch and Adjacent Properties, as well as all additional Areas of Concern.

For this scenario, it is predicted that the WWTP will experience a peak flow of 25.8 MGD with no capacity improvements made to the existing collection system. The inclusion of flow from Build Out growth is predicted to worsen capacity constraints and deficiencies on the Idaho Maryland and Main Trunk sewers. A plan view of model simulation results are presented in **Figure E-6**.

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The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.7.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Surcharging in manholes near the intersection of Idaho Maryland Road and East Main Street is predicted to worsen. MH N12-3 directly upstream of MH N13-3 is predicted to have a surcharge depth of 2.38 feet, therefore failing to meet the LOS criteria. Surcharging in MH N13-3 and MH N13-10 is predicted to increase to depths of 1.69 feet and 1.49 feet respectively, therefore failing to meet the LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.7.2 Main Trunk (from Idaho Maryland Road to WWTP):

Surcharging is expected to worsen as a result of higher flows and limited capacity in the twin 18" sewers crossing Highway 20. The surcharge depths of MH I17-7 and MH I17-3 are expected to increase to 4.13 feet and 2.76 feet respectively. MH J16-19, directly upstream of MH I17-7 and MH I17-3, is expected to surcharge to a depth of 1.75 feet, having a minimum freeboard of 7.20 feet, and therefore failing to meet the City's LOS criteria. Upstream of MH J16-19, is MH J16-16 which also fails to meet LOS criteria under this scenario. MH J16-16 is predicted to have a surcharge depth of 1.91 feet, and minimum freeboard of 7.44 feet. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.7.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.7.4 LOS Deficiencies:

The Manholes identified in **Table 4** fail to meet the LOS criteria under the Build Out + Dorsey Marketplace scenario.

Table 4 LOS Deficiencies for Build Out + Dorsey Marketplace

| MODELED RESULTS | | | | | | | |
|------------------------|-------|-------|--------|--------|--------|-------|-------|
| Manhole | I17-7 | I17-3 | J16-19 | J16-16 | N13-10 | N13-3 | N12-3 |
| Depth (feet) | 22.76 | 16.68 | 10.96 | 11.35 | 11.38 | 11.15 | 13.29 |
| Freeboard (feet) | 17.08 | 11.93 | 7.20 | 7.44 | 8.65 | 8.21 | 9.67 |
| Surcharge Depth (feet) | 4.13 | 2.76 | 1.75 | 1.91 | 1.49 | 1.69 | 2.38 |

DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Sewer Capacity Assessment Summary
October 21, 2016

6.0 SEWER CAPACITY ASSESSMENT SUMMARY

Based on the model results presented above, there are two major areas of concern in the City's wastewater collection system related to the Dorsey Marketplace Project assessment. The twin 18-inch sewers on the Main Trunk crossing Highway 20 have insufficient capacity and cause LOS failures at development scenarios beyond Existing conditions. Where the Idaho Maryland Trunk meets the Main Trunk at the intersection of Idaho Maryland Road and East Main Street throttling occurs and causes LOS failures under the Long Term growth scenarios and beyond. The results of the sewer capacity assessment in these areas are presented using the wastewater flow metrics defined in this report.

A discussion of capacity improvements to fix the LOS failures for the Existing + Vacant + Dorsey Marketplace and the Near Term + Dorsey Marketplace scenarios is presented below. These improvements only address the capacity constraints for MH I17-7 and do not address capacity improvements for growth scenarios beyond the Near Term. The modeling completed for this capacity assessment does not address changes in capacity due to future collection system improvements. If capacity constraints are removed upstream of the limits of this capacity assessment, peak flows in the study area will likely increase. Although capacity improvement solutions for further development scenarios are not presented in this analysis, an estimate of the percentage of peak flow contributed by the Proposed Project to the LOS failures is presented for both Near Term and Long Term growth scenarios.

6.1 TWIN 18-INCH SEWERS

The hydraulic model results identify failure of the LOS criteria in the Main trunk under all but the existing condition scenarios. Surcharging in this area is a result of insufficient capacity in the twin 18-inch sewers crossing underneath Highway 20. **Table 5** presents the wastewater flow metrics for the manholes failing the LOS criteria in the Main trunk.

Table 5 Sewer Capacity Flow Metrics for LOS Failures in the Main Trunk

| Level of Development | MH | Peak Flow (MGD) | Peak Surcharge (feet) | Loading Ratio | Residual capacity |
|----------------------------|--------|-----------------|-----------------------|---------------|-------------------|
| Existing + Vacant + Dorsey | I17-7 | 14.28 | 1.59 | 1.19 | -1.20 |
| Near Term + Dorsey | I17-7 | 15.14 | 2.32 | 1.25 | -1.58 |
| Long Term + Dorsey | I17-7 | 15.63 | 3.06 | 1.29 | -1.83 |
| Long Term + Dorsey | I17-3 | 13.17 | 1.27 | 0.76 | 4.16 |
| Build Out + Dorsey | I17-7 | 17.08 | 4.13 | 1.43 | -2.49 |
| Build Out + Dorsey | I17-3 | 13.97 | 2.76 | 0.8 | 3.49 |
| Build Out + Dorsey | J16-19 | 14.31 | 1.75 | 0.85 | 2.47 |
| Build Out + Dorsey | J16-16 | 13.65 | 1.91 | 1.06 | -0.79 |



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Sewer Capacity Assessment Summary
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The affected manholes include MH I17-7, MH I17-3, J16-16 and MH J16-19. All of these manholes become surcharged under the Build Out scenario. MH I17-7 has a depth of 22.8 feet, and meets LOS criteria until its surcharge depth becomes greater than 1 foot in the Existing + Vacant + Dorsey Marketplace scenario. MH I17-3 has a depth of 16.7 feet, and meets LOS criteria until its surcharge depth becomes greater than 1 foot in the Long Term + Dorsey Marketplace scenario. MH J16-9 has a depth of 11.0 feet and fails to meet the LOS criteria under the Build Out scenario, when surcharge depth becomes greater than 1 foot. It should be noted that this information is based upon a degree of upstream throttling due to capacity constraints within the system, and this surcharging will worsen as those capacity constraints are eliminated.

6.2 IDAHO MARYLAND AND EAST MAIN STREET INTERSECTION

The hydraulic model results identify failures of the LOS criteria in the Idaho Maryland Trunk under the Long Term and Build Out development scenarios. Surcharging in this area is due to lack of capacity at the intersection of two large trunks. **Table 6** presents the wastewater flow metrics for the manholes failing the LOS criteria in the Idaho Maryland Trunk.

Table 6 Sewer Capacity Flow Metrics for LOS Failures in the Idaho Maryland Trunk

| Level of Development | MH | Peak Flow (MGD) | Peak Surcharge (feet) | Loading Ratio | Residual Capacity |
|----------------------|--------|-----------------|-----------------------|---------------|-------------------|
| Long Term + Dorsey | N13-10 | 5.09 | 1.48 | 1.51 | -1.72 |
| Build Out + Dorsey | N13-10 | 5.23 | 1.6 | 1.55 | -1.86 |
| Build Out + Dorsey | N13-3 | 5.23 | 1.69 | 0.99 | 0.05 |
| Build Out + Dorsey | N12-2 | 5.23 | 2.38 | 1.04 | -0.2 |

The affected manholes are MH N13-10, MH N13-3, and MH N12-3, which all become surcharged under the Build Out scenario. MH N13-10 has a depth of 11.4 feet and becomes surcharged under the Existing + Vacant + Dorsey Marketplace scenario, but is still within LOS criteria with greater than 8 feet of freeboard and surcharging less than 1 foot. MH N13-10 meets LOS criteria until its surcharge depth becomes greater than 1 foot under the Long Term + Dorsey Marketplace scenario. MH N13-3, doesn't become surcharged until the Long Term + Dorsey Marketplace scenario and fails to meet the LOS criteria when its surcharge depth becomes greater than 1 foot under the Build Out + Dorsey Marketplace scenario. MH N12-3 only becomes surcharged under the Build Out + Dorsey Marketplace scenario, where it fails to meet the LOS criteria.

It should be noted that capacity constraints upstream of Springhill Drive are throttling flow, resulting in lower peak flows downstream. Should these constraints be eliminated, the capacity in this area will be significantly impacted and it may not be sufficient to convey the full flow, in accordance with City LOS criteria.



6.3 CAPACITY IMPROVEMENTS

Capacity constraints identified for the Existing + Vacant + Dorsey and the Near Term + Dorsey scenarios are primarily caused by limitations of the 18 inch twin sewers that pass under Highway 20. In order to address the capacity constraints identified at MH I17-7 for these scenarios one of the 18 inch lines will need to be upsized to 24 inches or an additional line will need to be added. This improvement is also identified in the City's Master Plan.

6.4 PERCENT RESPONSIBLE

To quantify the contribution to hydraulic loading from the Proposed Project, the percentage of the peak flow attributable to the Project that contributes to surcharging, above existing peak flow conditions, was calculated for Near Term and Long Term Conditions. This quantity can be called percent responsible and was calculated using peak flows in the portions of the system that convey flows from the Proposed Project and also fail the City's LOS criteria.

As described in the Model results above, MH I17-7 is the only manhole that conveys Dorsey Marketplace flows and fails the LOS criteria under Near Term conditions. The percent of peak flow attributable to the Proposed Project has been calculated as 12.6%. The percent responsible was calculated by determining the amount of peak flow in the manhole due to Dorsey Marketplace only, and dividing that by the peak flow being contributed by all Near Term development (including Dorsey Marketplace but excluding all existing flows). The calculations determining the percent responsible for MH I17-7 under Near Term conditions are shown below:

$15.14 \text{ MGD} - 12.76 \text{ MGD} = 2.38 \text{ MGD}$ additional peak flow in I17-7 contributed by Near Term development

$15.14 \text{ MGD} - 14.84 \text{ MGD} = 0.3 \text{ MGD}$ difference between peak flow in I17-7 with and without Dorsey Market Place

$0.3/2.38 = 0.126 = 12.6\%$ percent of flow contribution from the Dorsey Marketplace Project over and above existing flows.

Under the Long Term development scenario, MH I17-7, MH I17-3, and MH N13-10 are predicted to fail the LOS criteria. The percent contribution to peak flow from the Dorsey Marketplace Project has been calculated for each of these manholes. The peak flows and percent responsible for all three manholes are presented in **Table 7**.

DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Sewer Capacity Assessment Summary
October 21, 2016

Table 7 Percent Responsible

| Level of Development | Peak Flow (MGD) | Dorsey Marketplace Contribution to Peak Flow (MGD) | % Responsible |
|----------------------|-----------------|--|---------------|
| Manhole I17-7 | | | |
| Existing | 12.76 | - | - |
| Near Term | 15.14 | 0.3 | 12.6% |
| Long Term | 15.63 | 0.34 | 11.8% |
| Manhole I17-3 | | | |
| Existing | 10.41 | - | - |
| Long Term | 13.17 | 0.31 | 11.2% |
| N13-10 | | | |
| Existing | 3.03 | - | - |
| Long Term | 5.09 | 0.32 | 15.5% |

EXHIBITS

DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Exhibit A Flow Projections by Genesis Engineering
October 21, 2016

Exhibit A FLOW PROJECTIONS BY GENESIS ENGINEERING

SANITARY SEWER PIPE SIZING

SCOPE:

Provide calculations for sewer pipe sizing based on the City of Grass Valley Engineering Standards for Dorsey Drive.

SITE:

The site will consist of a total of 26.42 acres. 22.59 acres will be used for commercial design and the remaining 4.15 acres will be used for multi-family residential design. It is proposed to have 90 dwelling units for the residential.

CALCULATIONS:

From Table 8-1 of Section 8 of the City of Grass Valley Design Standards

| LAND USE DESIGNATION | UNITS | WASTEWATER GENERATION FACTOR (GPD/UNIT) |
|--------------------------|----------|---|
| Commercial/Industrial | Acre | 850 |
| Residential Multi Family | Dwelling | 135 |

Per the City of Grass Valley Design Standards a Factor of Safety of 2 is required along with a Peaking Factor.

| | |
|---------------------------------------|-------------------------------|
| Commercial Average Dry Weather Flow: | 22.59acres x 850 = 19,202 gpd |
| Residential Average Dry Weather Flow: | 90 units x 135 = 12,150 gpd |
| TOTAL: | 31,352 gpd |
| Factor of Safety of 2: | 62,704 gpd = 0.06 MGD |
| Peaking Factor per Figure 1: | 4.8 |
| TOTAL: | 300,979 gpd = 0.30 MGD |
| GRAND TOTAL: | 0.30 MGD |

CONCLUSION:

Based on the calculations and the City of Grass Valley Design Standards an 8" pipe with a minimum slope of 0.0035 will be required to handle the sewer flows for Dorsey Drive.

DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Exhibit B Survey Data
October 21, 2016

Exhibit B SURVEY DATA

SSMH/8107/#N11-4
RIM 2539.60
INV 6"PVC (SE) IN ELEV. 2535.60
INV 12"RCP (NE) IN ELEV. 2535.05
INV 15"? (NW) IN ELEV. 2526.50
INV 15"? (NE) IN ELEV. 2526.40
INV 15"? (SW) OUT ELEV. 2526.35

SSMH/P11-2
RIM=2606.24
INV=8"? (S) OUT 2602.04

SSMH/P11-1
RIM=2589.17
INV=8"? (N) IN 2583.17
INV=8"? (SE) OUT 2583.07

SSMH/Q11-5
RIM=2562.67
INV=8"? (NW) 2557.27
INV=8"? (SE) 2557.17

SSMH/Q12-9
RIM=2546.18
INV=8"? (N) IN 2541.98
INV=8"? (S) OUT 2541.90

SSMH/Q12-8
RIM=2530.55
INV=6"? (W) IN 2525.75
INV=8"? (N) IN 2525.70
INV=8"? (S) OUT 2525.60

SSMH/#012-3
RIM=2459.67
INV=15"? (E) IN 2450.57
INV=15"? (W) OUT 2450.47

SSMH/#012-4
RIM=2461.16
INV=8"? (N) IN 2453.16
INV=15"? (S) IN 2451.26
INV=15"? (W) OUT 2451.16

SSMH/#P12-2
RIM=2478.54
INV=15"? (NE) IN 2470.04
INV=15"? (SW) OUT 2469.94

2503.66
Q12-1 Idaho Maryland Rd

SSMH/8204/#Q12-1
RIM 2492.28
INV 6"? (N) IN ELEV. 2483.98
INV 18"? (E) IN ELEV. 2483.93
INV 18"? (W) OUT ELEV. 2483.73

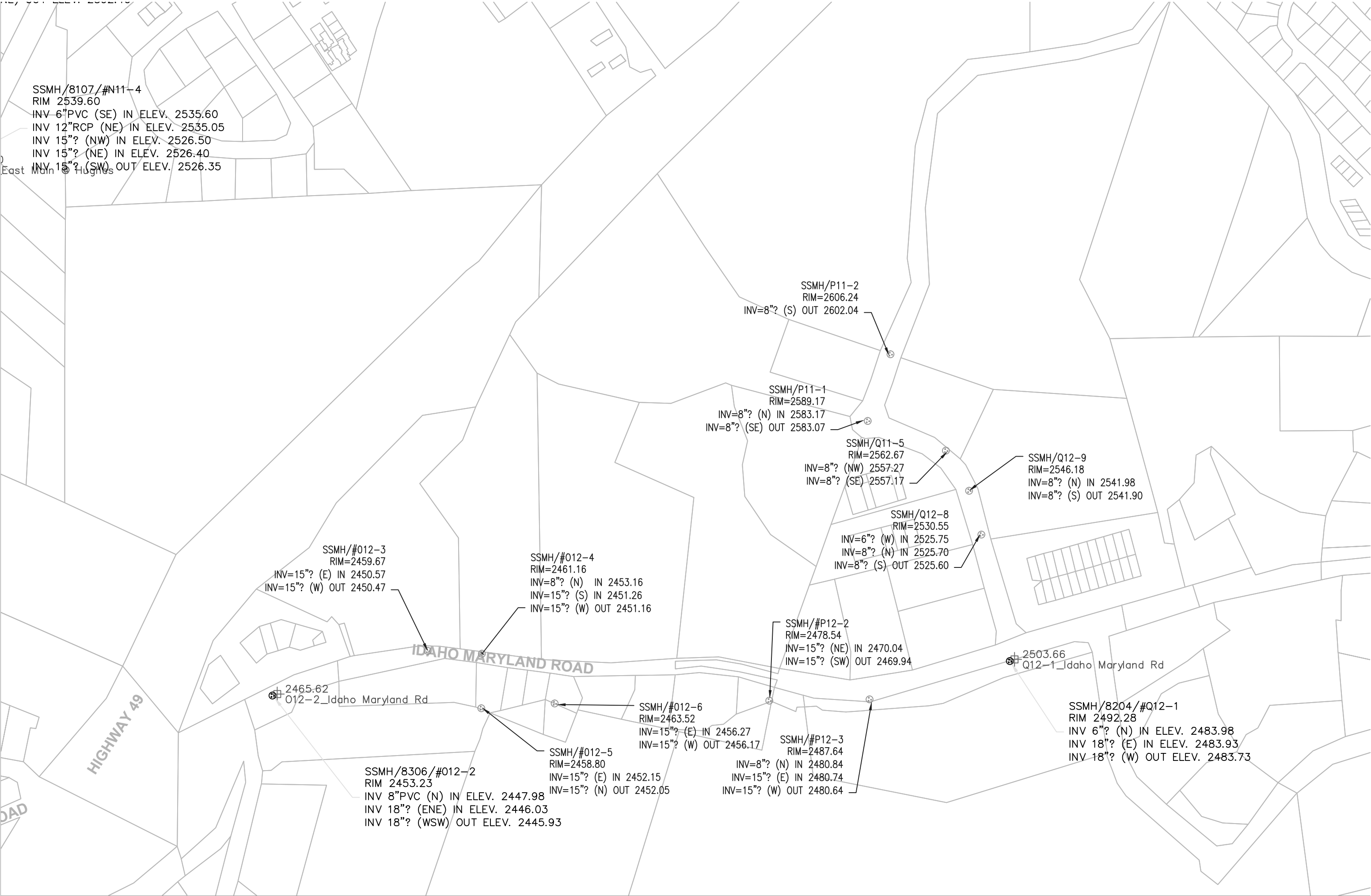
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INV=15"? (W) OUT 2456.17

SSMH/#P12-3
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INV=8"? (N) IN 2480.84
INV=15"? (E) IN 2480.74
INV=15"? (W) OUT 2480.64

SSMH/#012-5
RIM=2458.80
INV=15"? (E) IN 2452.15
INV=15"? (N) OUT 2452.05

SSMH/8306/#012-2
RIM 2453.23
INV 8"PVC (N) IN ELEV. 2447.98
INV 18"? (ENE) IN ELEV. 2446.03
INV 18"? (WSW) OUT ELEV. 2445.93

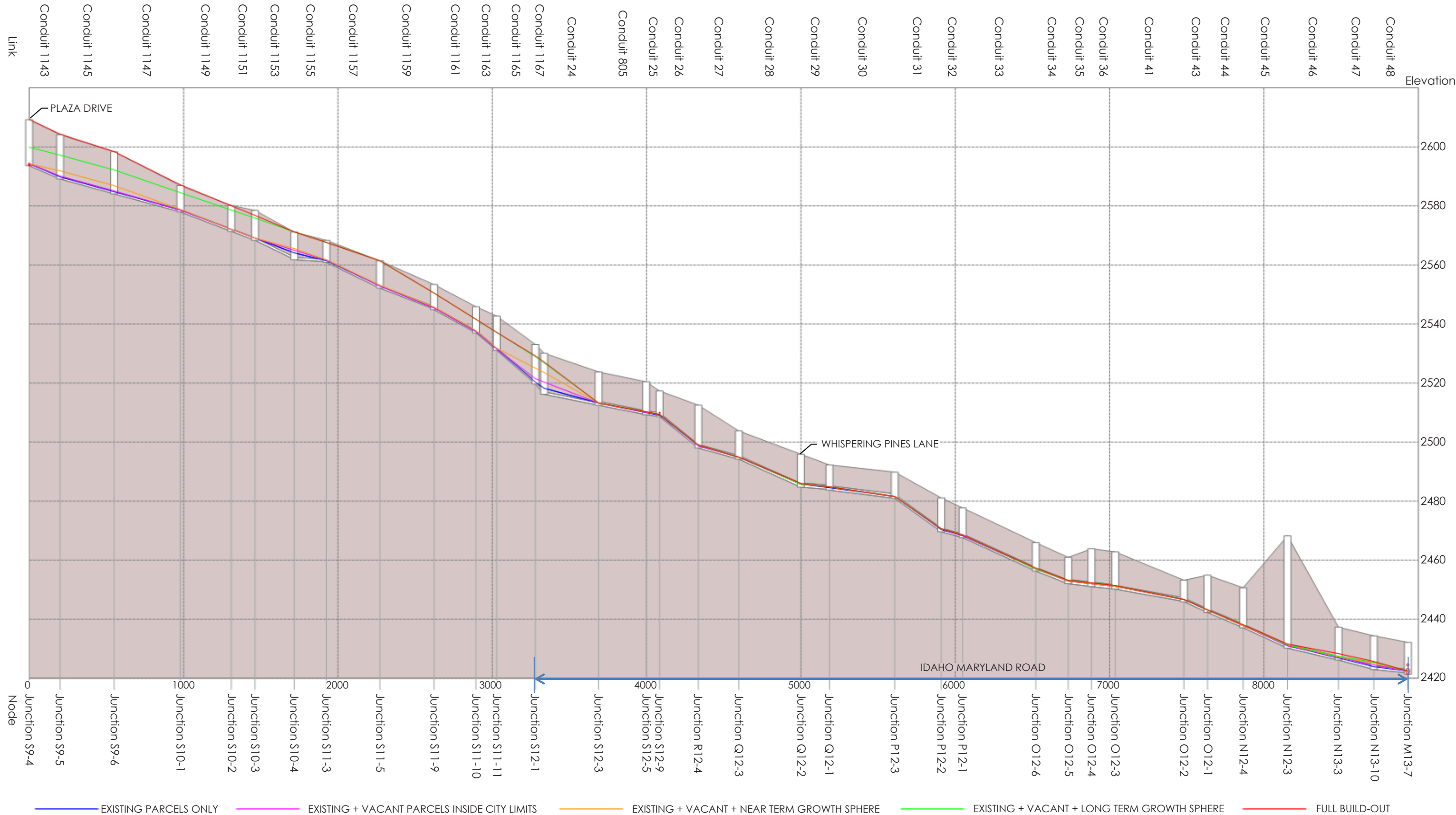
2465.62
O12-2 Idaho Maryland Rd



DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

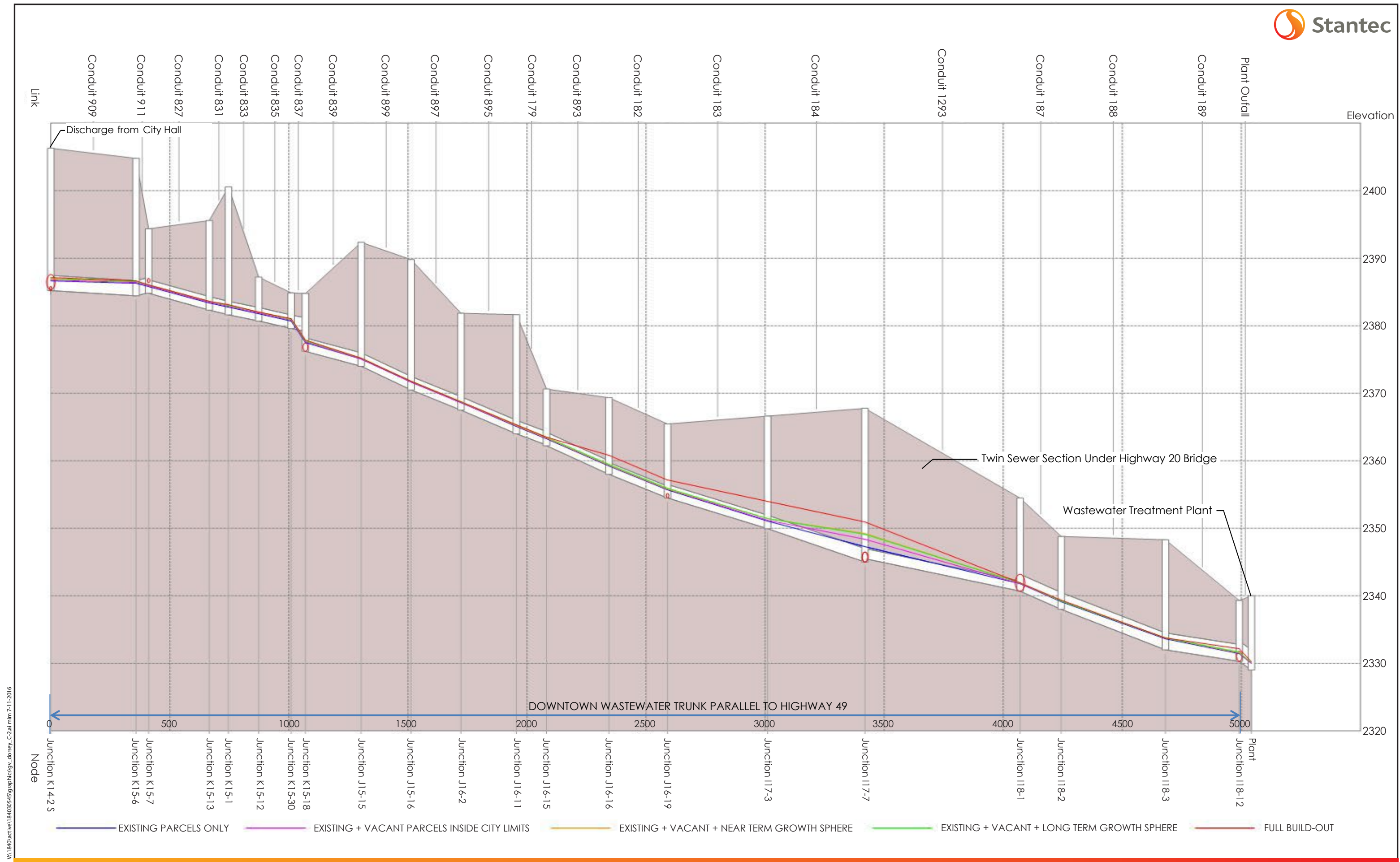
Exhibit C City of Grass Valley Wastewater System Master Plan HGL Profiles
October 21, 2016

**Exhibit C CITY OF GRASS VALLEY WASTEWATER SYSTEM
MASTER PLAN HGL PROFILES**



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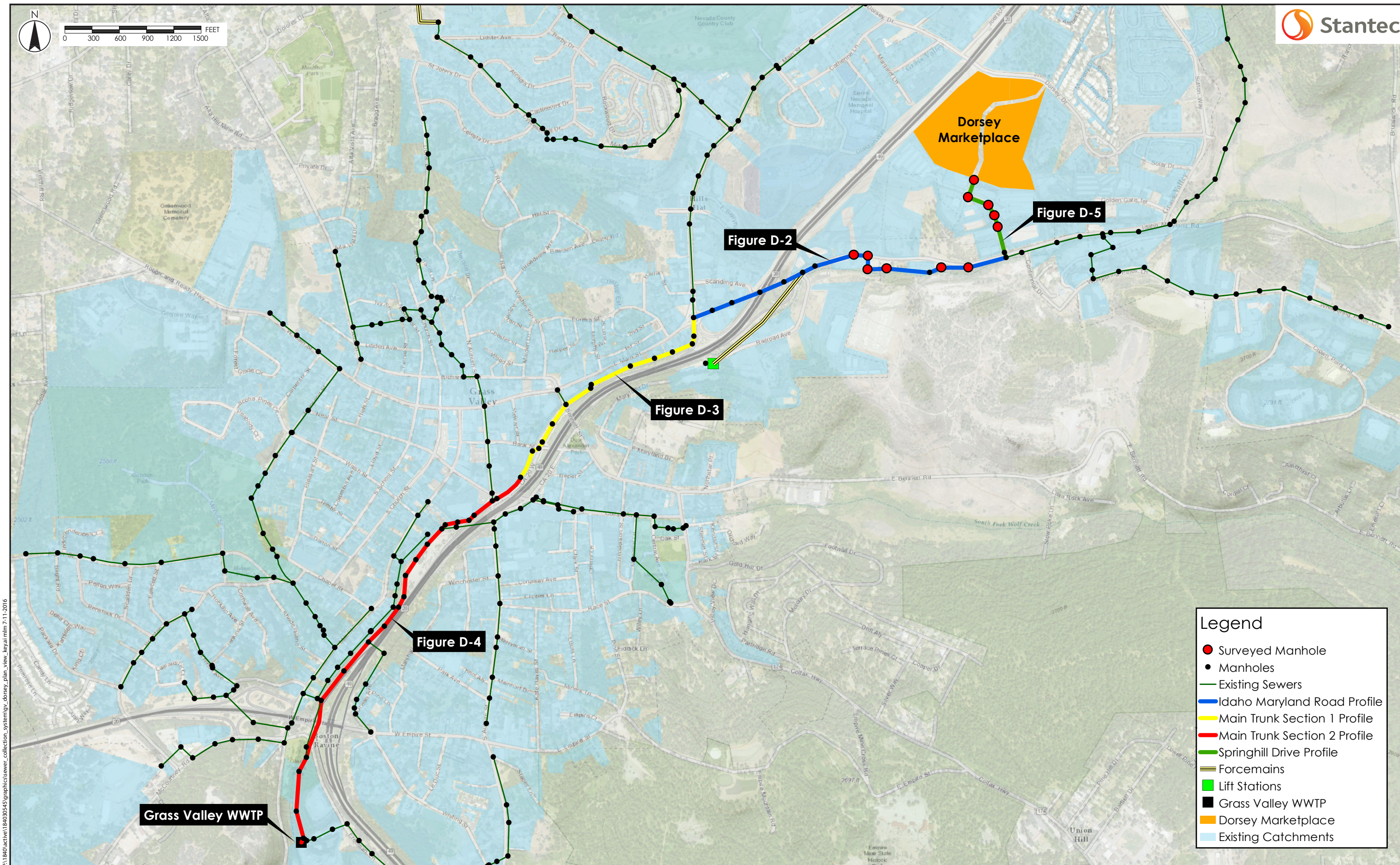
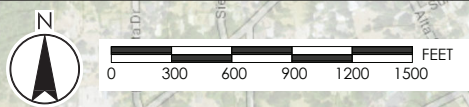


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DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

Exhibit D HGL Profiles
October 21, 2016

Exhibit D HGL PROFILES

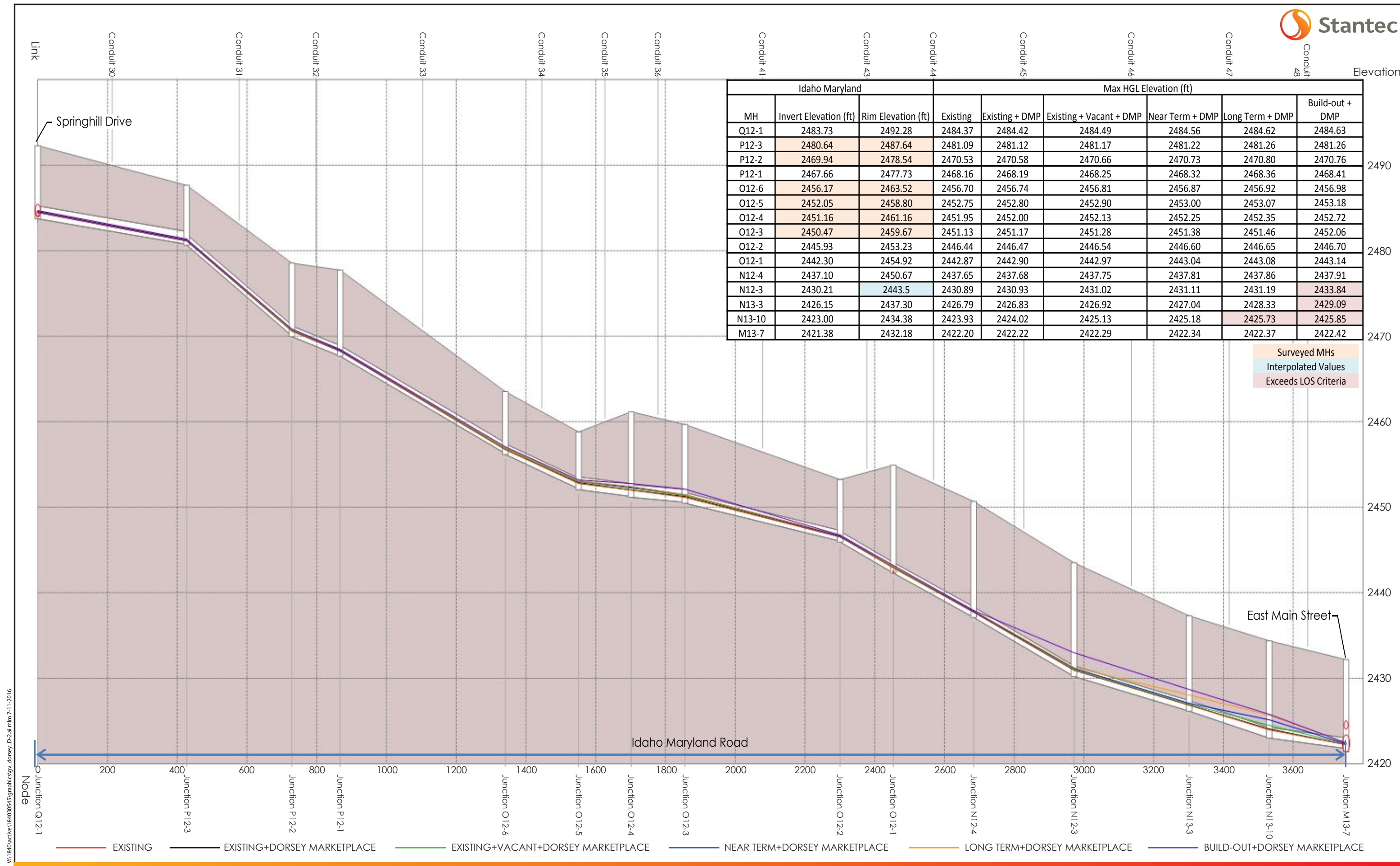


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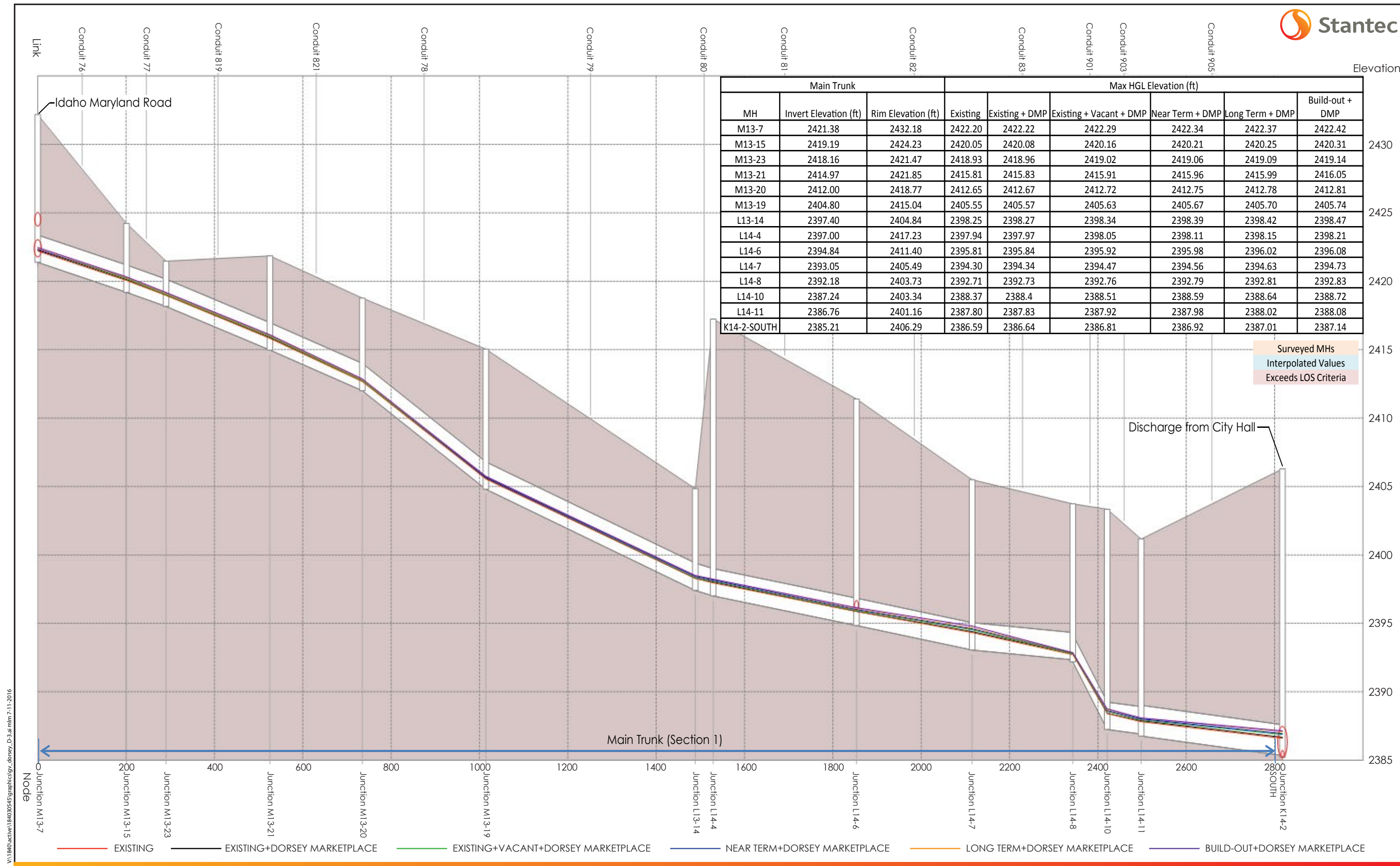
- Surveyed Manhole
- Manholes
- Existing Sewers
- Idaho Maryland Road Profile
- Main Trunk Section 1 Profile
- Main Trunk Section 2 Profile
- Springhill Drive Profile
- Forcemains
- Lift Stations
- Grass Valley WWTW
- Dorsey Marketplace
- Existing Catchments

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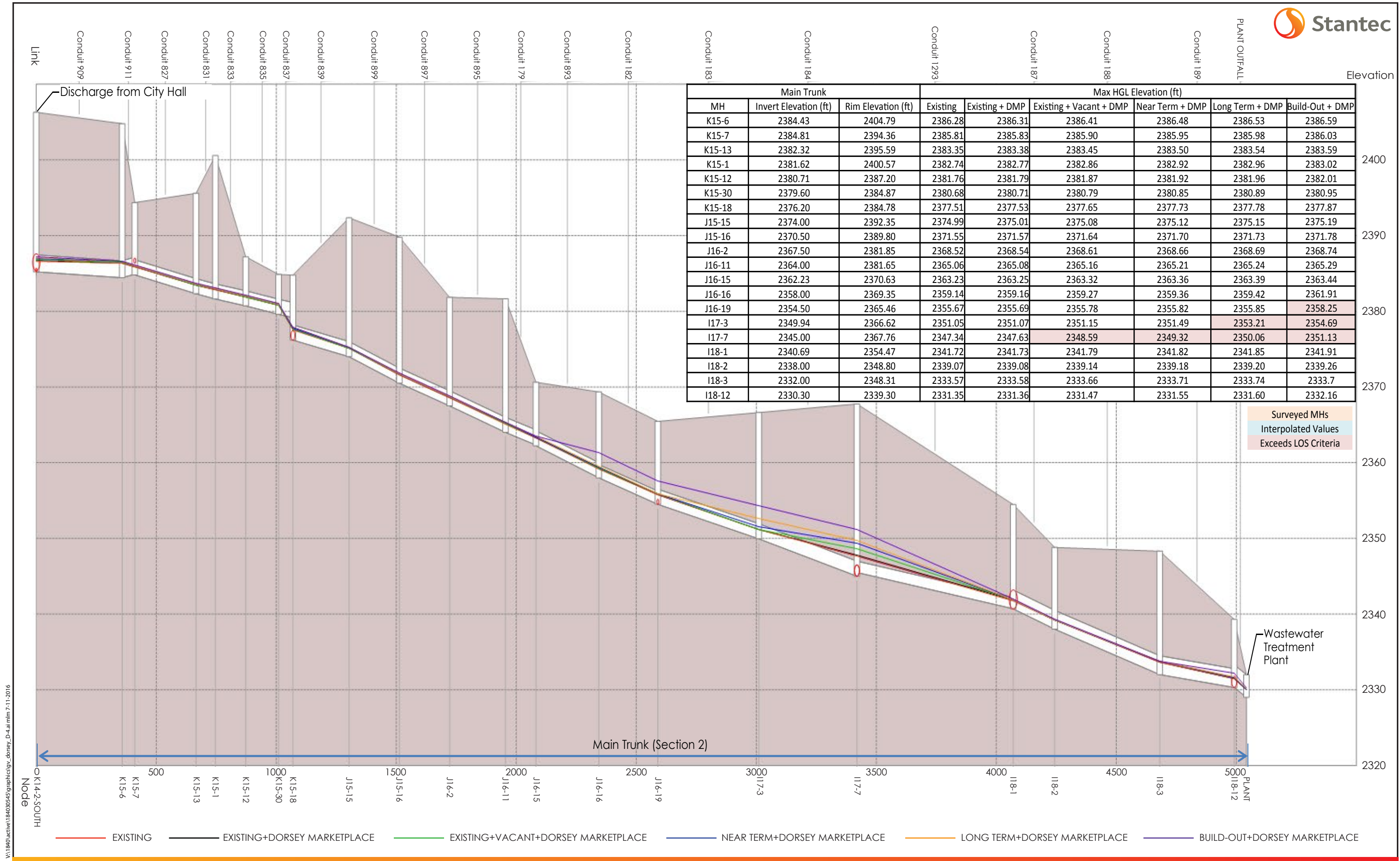




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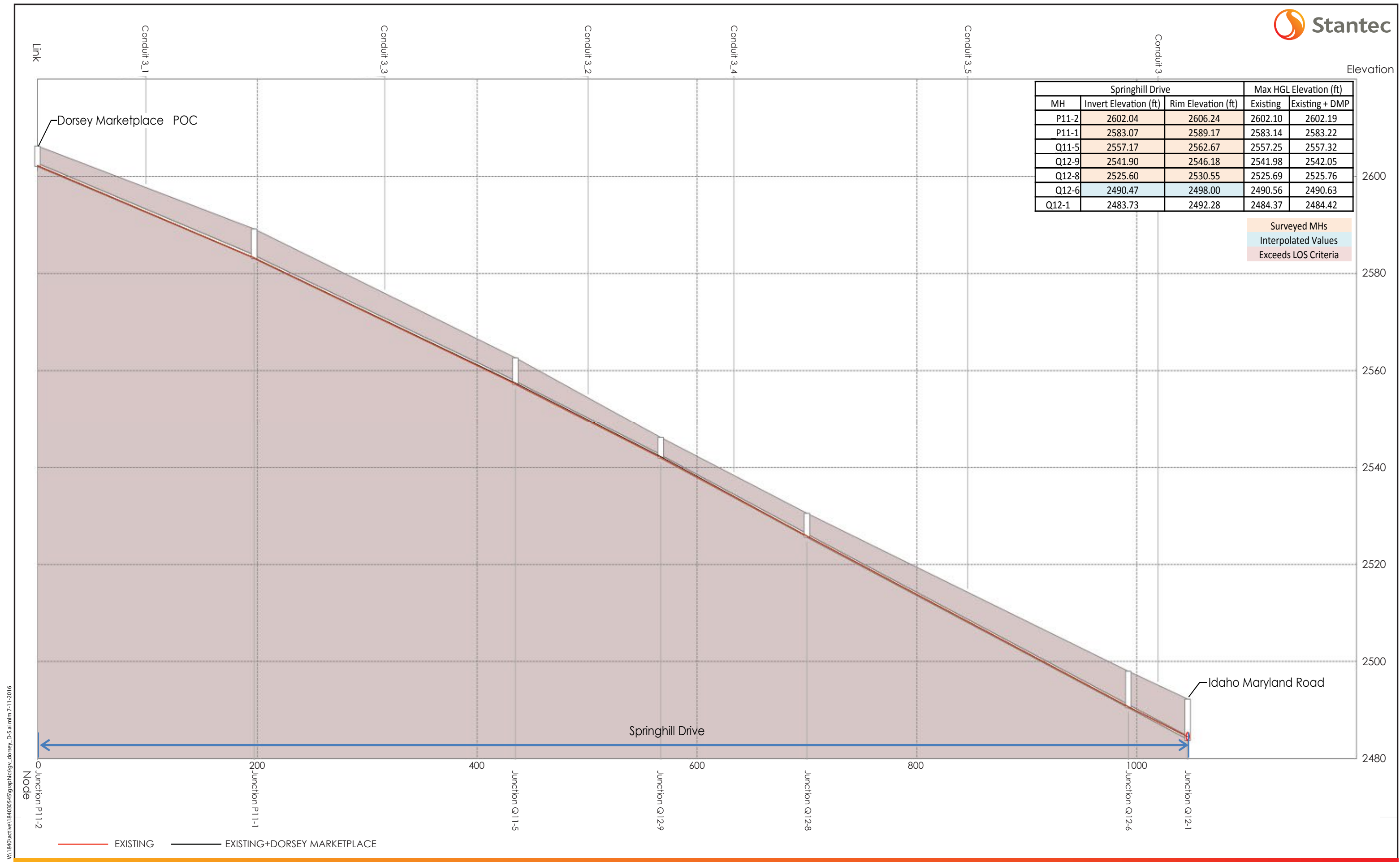


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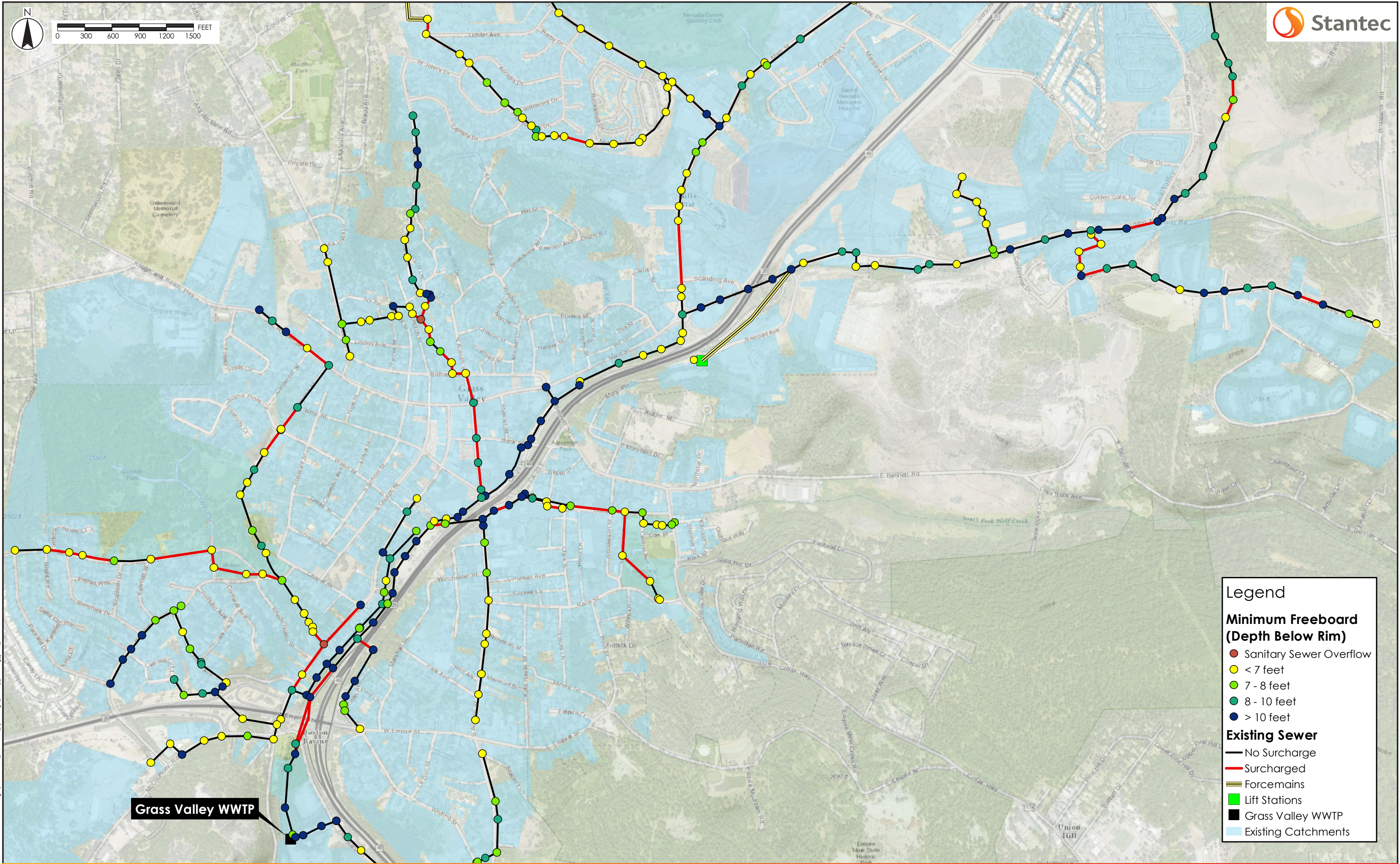


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DORSEY MARKETPLACE PROJECT TECHNICAL MEMORANDUM NO. 1

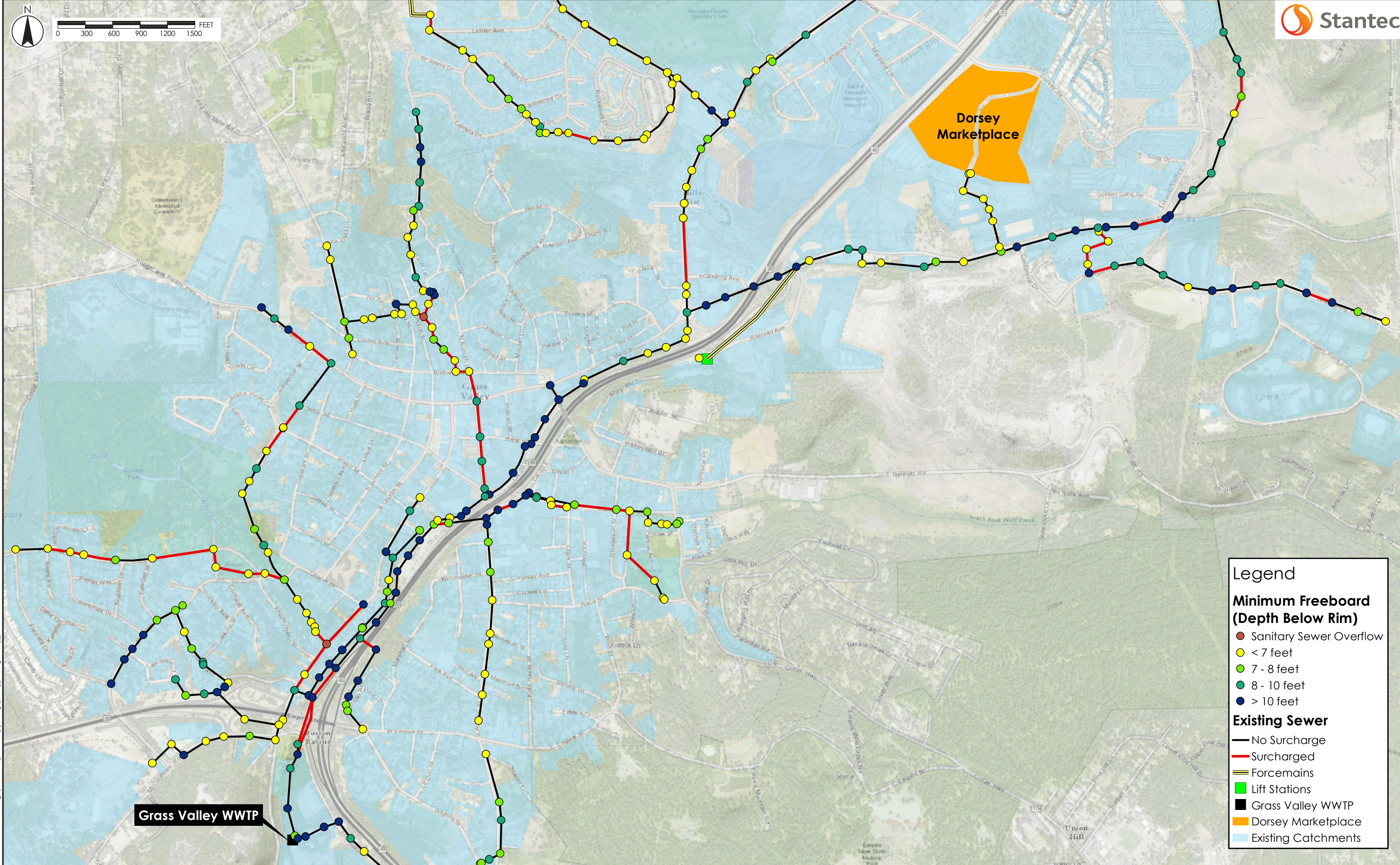
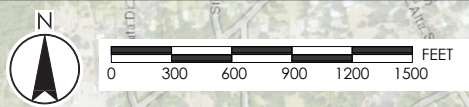
Exhibit E Plan View Figures
October 21, 2016

Exhibit E PLAN VIEW FIGURES



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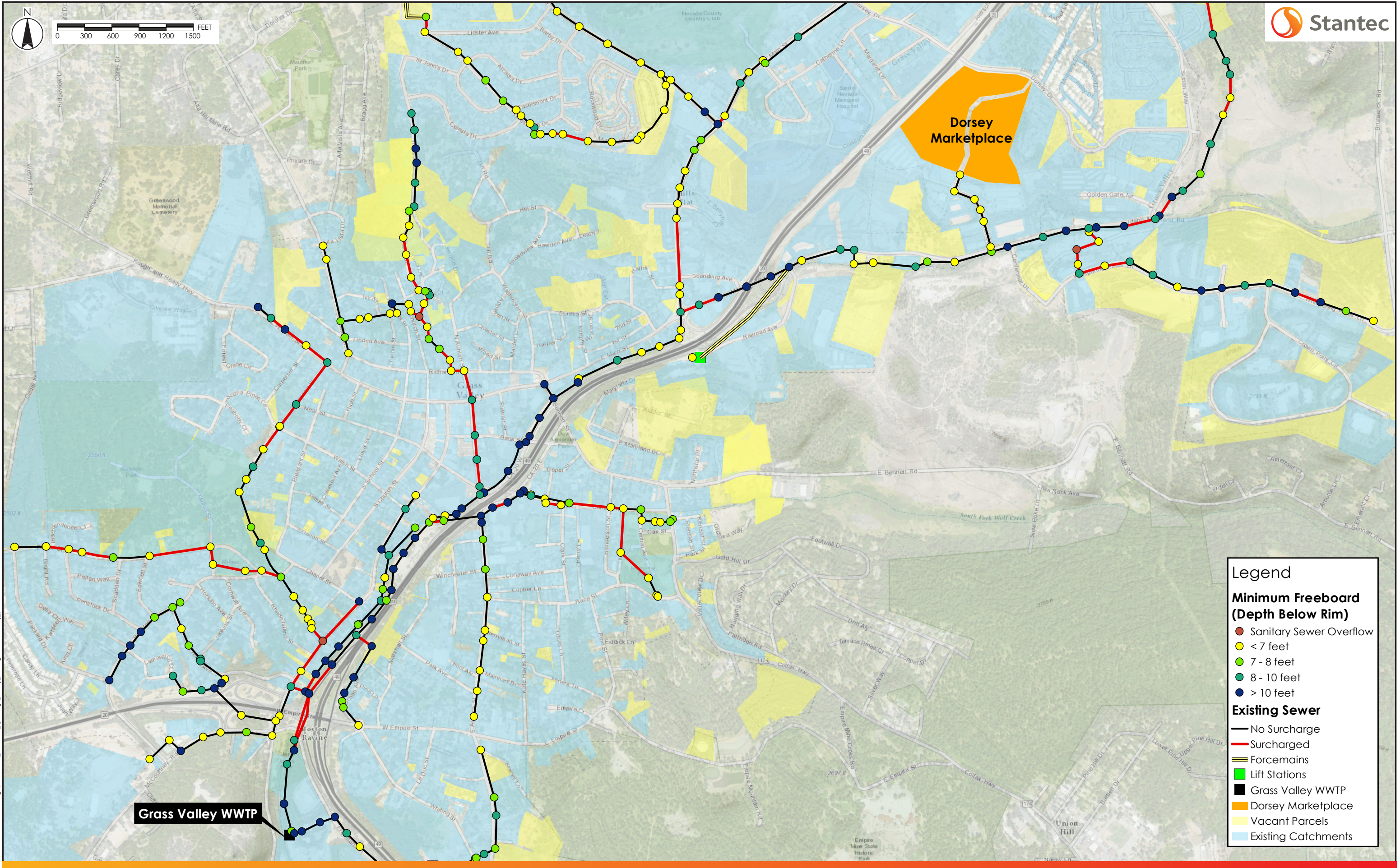
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Minimum Freeboard (Depth Below Rim)

- Sanitary Sewer Overflow
- < 7 feet
- 7 - 8 feet
- 8 - 10 feet
- > 10 feet

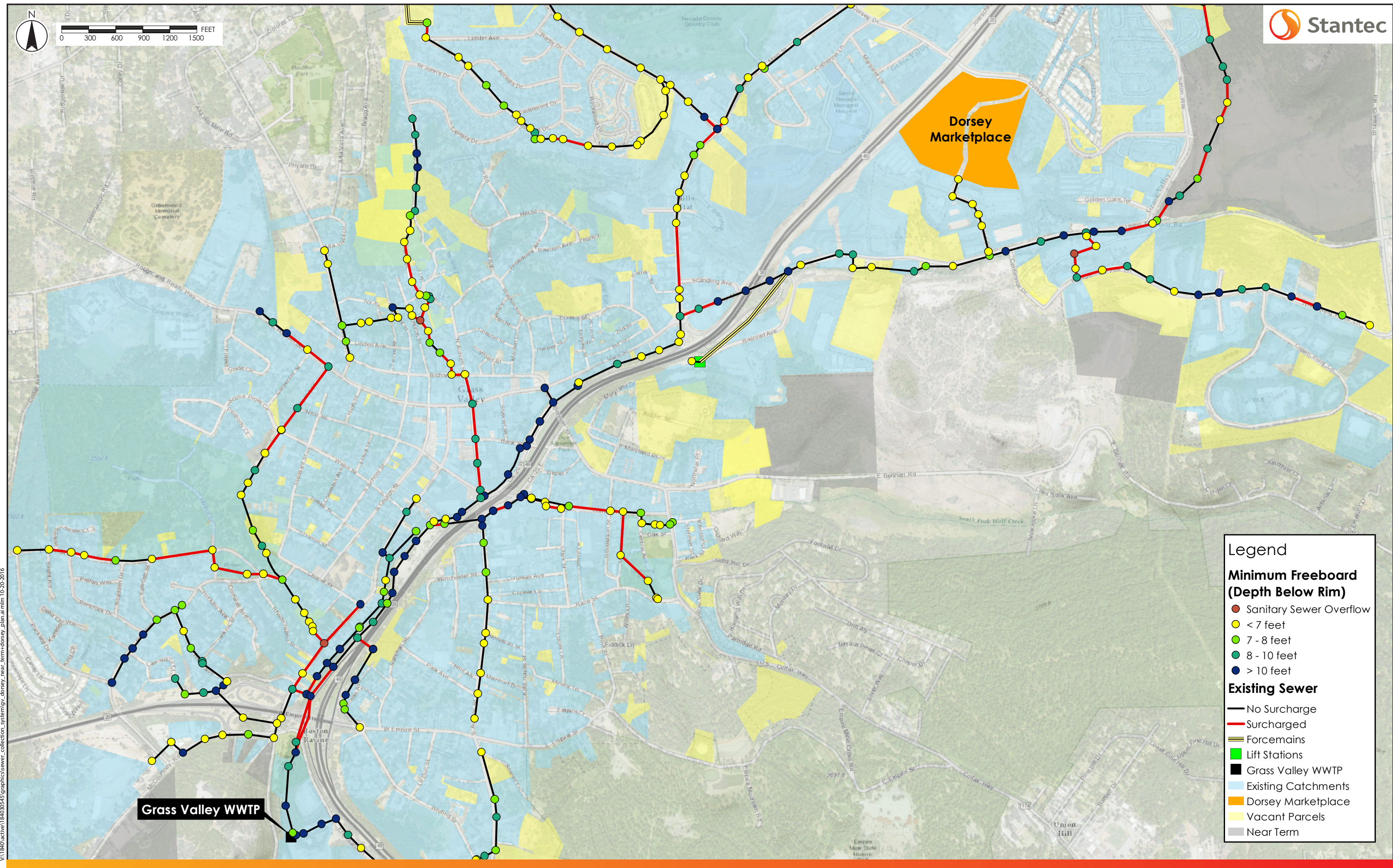
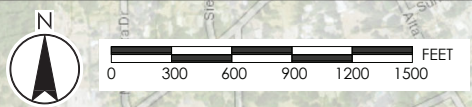
Existing Sewer

- No Surge
- Surged
- Forcemains
- Lift Stations
- Grass Valley WWTW
- Dorsey Marketplace
- Existing Catchments



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Legend

Minimum Freeboard (Depth Below Rim)

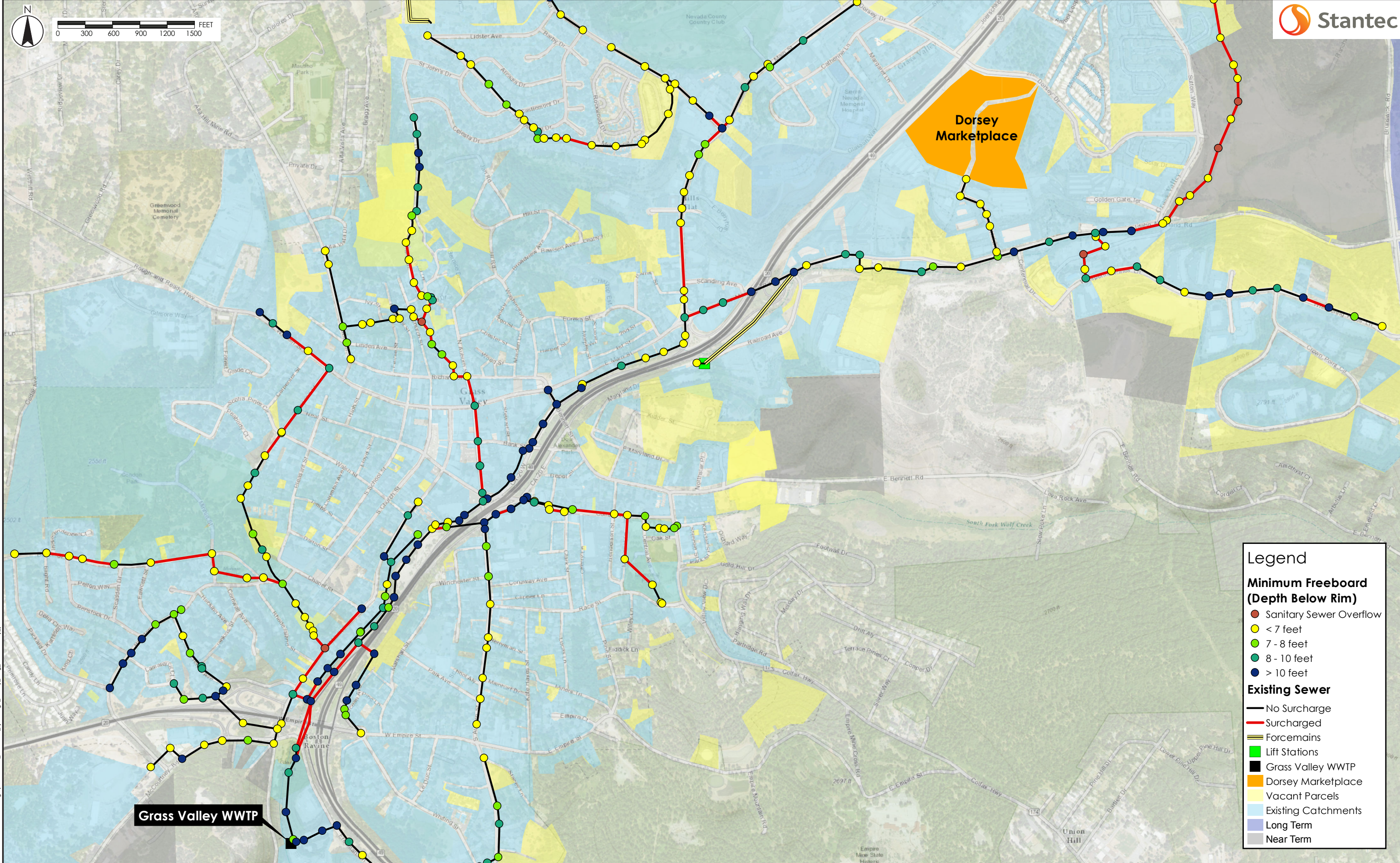
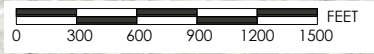
- Sanitary Sewer Overflow
- < 7 feet
- 7 - 8 feet
- 8 - 10 feet
- > 10 feet

Existing Sewer

- No Surcharge
- Surcharged
- Forcemains
- Lift Stations
- Grass Valley WWTW
- Existing Catchments
- Dorsey Marketplace
- Vacant Parcels
- Near Term

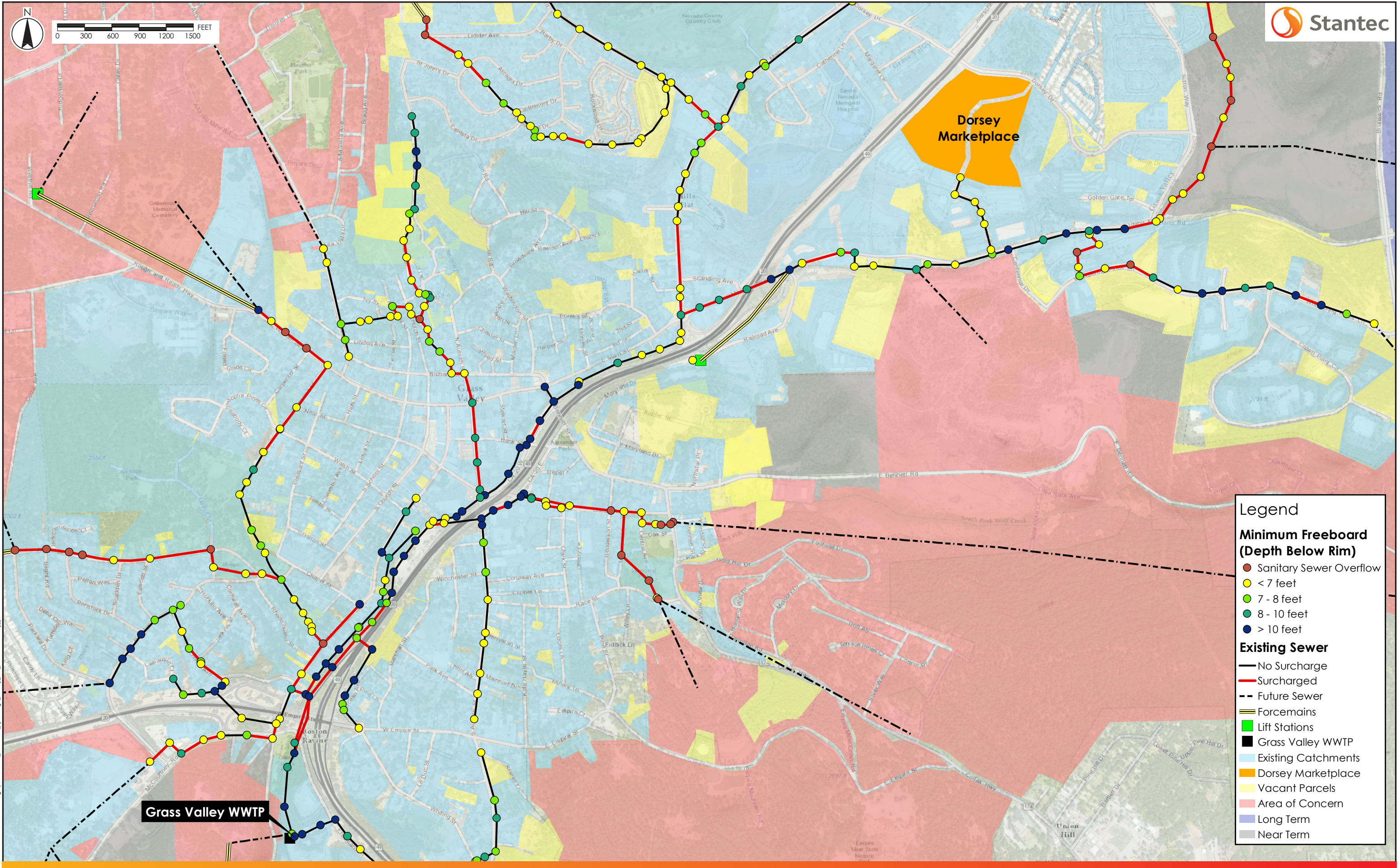
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|-------|--|-------|---|
| To: | Katherine Waugh Dudek 853 Lincoln Way, Suite 208 Auburn, CA 95603 | From: | Breanna Webb Stantec Consulting Services, Inc. 101 Providence Mine Road, Suite 202 Nevada City, CA 95959 |
| File: | 184030545 | Date: | October 5, 2018 |

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Stantec completed a sewer capacity assessment to evaluate the specific impacts of the proposed Dorsey Marketplace development (Project) on the wastewater collection system of the City of Grass Valley (City). The results of this evaluation were presented within the Technical Memorandum (TM) titled *Dorsey Marketplace Project Technical Memorandum No. 1 – Sewer Capacity Assessment* (TM No.1), prepared by Stantec in October of 2016. Since the preparation of TM No. 1, the Dorsey Marketplace has developed an alternative site plan, to the one considered in TM No. 1. The original site plan, used to develop TM No.1, will be referred to herein as Alternative A, while the revised site plan will be referenced as Alternative B. The Alternative B site plan features expanded residential areas, a reduced commercial area, and added office space. The purpose of this technical memo is to provide an additional sewer capacity impact assessment of the development under the conditions presented in the Alternative B site plan. TM No. 1, the assessment of the capacity impacts to the collection system of the original site plan (Alternative A), is attached to the TM as **Attachment 1**.

This TM is divided into the following sections:

1. Background – TM No. 1
2. Alternative B – Dorsey Marketplace Alternative Site Plan
3. Wastewater Flow Projections
4. Sewer Capacity Assessment
5. Summary of Alternatives & Sewer Capacity Impacts

1.0 BACKGROUND – TM NO. 1

The purpose of this section is to summarize the project background and results presented in the original capacity assessment for the Dorsey Marketplace project presented in Dorsey Marketplace Project Technical Memorandum No. 1 – Sewer Capacity Assessment (Attachment 1). Only a summary of the project background and assessment results are presented here. The full TM can be referenced for additional details in Attachment 1. The proposed Dorsey Marketplace consists of a new, integrated, mixed-use, infill, retail, commercial and residential development project. The proposed Dorsey Marketplace development is located at the southeast corner of Dorsey Drive and Highway 49 within the City of Grass Valley, California. The proposed project location is shown in **Figure 1**. The project is located on a 26.9-acre former mine site, on the south side of Dorsey Drive. The development will have two entrances, one on Dorsey Drive and the other on Springhill Drive. It is assumed that wastewater from either site plan will be routed in the same way to the City's wastewater collection system. The current utility plan routes wastewater by gravity through an existing 8-inch sewer collector in Springhill Drive, which connects to an 18-inch trunk sewer in Idaho Maryland Road. The Idaho Maryland Trunk sewer connects to the City's Main Trunk sewer, which conveys wastewater to the City's wastewater treatment plant (WWTP).



Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

TM No. 1 was developed to provide the City of Grass Valley with an assessment of the impacts the Proposed Project would have on the City wastewater collection system, under the Alternative A site plan. An estimate of wastewater flow from the development was approximated using the City's Design Standards. The wastewater collection capacity assessment was performed using the hydraulic model of the City's wastewater collection system. The hydraulic model of the City's wastewater collection system was modified to include segments of sewer connecting the new development to the existing system. As part of the model update survey data was collected for the wastewater sewer in Springhill Drive. A new model with updated wastewater flow estimates and survey information was run for each development scenario considered within the City's Wastewater System Master Plan (Master Plan). These model scenarios include:

- Existing Conditions
- Existing + Development of Vacant Parcels
- Near Term Development
- Long term Development
- Build Out Growth

The results of the model simulations were compared to those presented in the Master Plan. TM No. 1 concludes that there are two major areas of concern in the City's wastewater collection system downstream of the Dorsey Marketplace development. The twin 18-inch sewers on the Main Trunk crossing Highway 20 have insufficient capacity at development scenarios beyond the Existing condition. Where the Idaho Maryland Trunk meets the Main Trunk, at the intersection of Idaho Maryland Road and East Main Street throttling occurs under Long-Term development conditions and beyond. The flows from the Alternative A site plan are expected to exacerbate these capacity limitations.

2.0 ALTERNATIVE B – DORSEY MARKETPLACE ALTERNATE SITE PLAN

The purpose of this section is to provide a description of the Alternative B site plan for the Dorsey Marketplace development. The Alternative A site plan designated the land use of the parcel as 22.6 acres of commercial area, with approximately 180,000 square feet (SF) of retail space and 5.7 acres of "urban high density" residential area, with 90 equivalent dwelling units (EDUs). Alternative B proposes a new site configuration with a slightly modified distribution of land uses as compared to Alternative A. **Table 1** presents the site plan land use configurations for both alternatives. The Alternative B site plan expands the southern residential area to the west, adding approximately 81 EDUs to the original configuration. There are a total of 171 EDUs proposed in the Alternative B site plan. Approximately 8,500 SF of office space is also integrated into the site as a buffer between residential and commercial areas. The commercial area is reduced to approximately 14.2 acres¹ and 105,000 SF of retail space.

¹ Acreages of non-residential area was not provided for use in this analysis, only square footage of commercial and office building space was available. Therefore, the ratio of non-residential square footage to non-residential acreage from Alternative A was used to determine equivalent non-residential acreages for the Alternative B site plan. [22.6 acres/180,000 SF x (105,000 SF + 8,500 SF) = 14.2 acres]

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Table 1 Land Uses of Site Plan Alternatives

| Land Use | Alternative A | Alternative B |
|---|----------------------|----------------------|
| Commercial Building Space (SF) | 180,000 | 105,000 |
| Office Building Space (SF) | | 8,500 |
| Total Non-Residential Building Space (SF) | 180,000 | 113,500 |
| Residential (EDU) | 90 | 171 |
| Total Non- Residential (Acres) ^(a) | 22.6 | 14.2 |

(a) Total non-residential acres include the total commercial and office portion of the development, including drainages, parking lots, and other features outside of building space.

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

3.0 WASTEWATER FLOW PROJECTIONS

Wastewater flow projections for the Dorsey Marketplace development were calculated to assess the impact of the developments added wastewater flow on the City's collection system. The purpose of this section is to present the projected wastewater flows for each of the Dorsey Marketplace site plan alternatives and provide a description of the methods used for their development. Flow projections used for the analysis of the Alternative A site plan presented in TM No. 1, and the Alternative B site plan, were provided and checked with the City of Grass Valley Engineering Standards (Design Standards). The City's Design Standards present wastewater generation rates for residential and non-residential land use types. Commercial and office land uses are assigned 850 gallons per day (gpd)/acre and wastewater estimates for residential land use are quantified by EDU, equating to 135 gpd/EDU (high density EDU). These wastewater generation rates are used to develop the Average Dry Weather Flow (ADWF) estimate for the development using the land use data from each site plan. Wastewater flow estimates for both Alternatives can be found in **Table 2**.

To assess the full impact of the development on the wastewater collection system, Peak Wet Weather Flow (PWWF) estimates must be determined. The PWWF is the peak wastewater flow value consisting of base flow, groundwater infiltration, and Rainfall Dependent Inflow and Infiltration (RDII). Base flow is wastewater contributed directly from the development. Groundwater infiltration is caused by shallow groundwater entering the cracks and imperfections of the wastewater collection system and RDII is considered stormwater that enters the wastewater collection system directly (inflow) or indirectly (infiltration). Inflow into the wastewater collection system causes the peak wastewater flow to occur during or subsequently after the peak rainfall intensity during a storm event. Inflow can enter the collection system through improperly connected roof leaders, open or cracked manhole covers, or other direct flow paths into system.

The City's Design Standards outline the methods for determining PWWF. A safety factor of two (2) is applied to the ADWF estimate developed from the developments land uses. An additional Peaking Factor (PF) is then applied to this value to determine the approximate PWWF. The peaking factor described in the Design Standards is dependent on the ADWF estimate. Additional information and the City's Design Standards can be found in TM No. 1 (Attachment 1). The PWWF for both Alternatives is presented in **Table 2**.

The Alternative A site plan produced a PWWF estimate of approximately 0.301 MGD, as presented in TM No. 1. An approximate PWWF was developed for the Alternative B site plan using the same method, as described in the City's Design Standards. The total non-residential square footage of the Alternative B site plan was estimated using the ratio of the Building Space to Non-Residential Area presented for Alternative A. A total of 14.2 acres of commercial and office area was used to develop the Alternative B wastewater flow estimate as shown in **Table 1**.

The added residential area and reduced commercial space increases the projected PWWF estimate from 0.301 MGD to 0.325 MGD for Alternative B. The total ADWF for Alternative B equates to approximately 70,400 gpd after applying the factor of safety. A PF of 4.6 is required to determine PWWF at this ADWF.

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Table 2 Wastewater Flow Estimates for Alternative Site Plans

| Flow Parameter | Alternative A | Alternative B |
|---|----------------------|----------------------|
| Non-Residential Wastewater Flow (gpd) – <i>850 gpd/acre</i> | 19,210 | 12,070 |
| Residential Wastewater Flow (gpd) – <i>135 gpd/EDU</i> | 12,150 | 23,085 |
| Total ADWF (gpd) | 31,360 | 35,155 |
| Factored ADWF (gpd) – <i>Safety Factor of 2</i> | 62,720 | 70,310 |
| PF | 4.8 | 4.6 |
| PWWF (gpd) | 301,056 | 323,062 |
| Rounded PWWF (MGD) | 0.300 | 0.325 |

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

4.0 SEWER CAPACITY ASSESSMENT

The purpose of this section is to describe the methods used to determine the results of the sewer capacity assessment for the Dorsey Marketplace development, including the City's hydraulic models, assessment criteria, and level of service requirements.

4.1 SEWER CAPACITY ASSESSMENT CRITERION

A hydraulic model of the City of Grass Valley wastewater collection system was developed as part of the City's Wastewater Master Plan. This model was modified for use in this assessment and the preceding assessment (TM No. 1) to determine the impacts of the Dorsey Marketplace development on the City's collection system. The hydraulic models developed to assess the impact of the Alternative A site plan (described in TM No. 1) were copied and modified to assess the PWWF estimate developed for the Alternative B site plan. The models were used to evaluate the capacity of the collection system and identify limitations, such as bottlenecks and infrastructure unable to accommodate projected flow. The ability for a sewer to accommodate future development is defined by the City's Level of Service (LOS) performance criteria. The criteria define whether or not collection system components are operating effectively based on quantifiable metrics which can be extracted from model simulation results.

The results of each model simulation are assessed using four wastewater flow metrics:

1. **Peak Flow** – Evaluated at specific locations within the collection system under PWWF conditions.
2. **Minimum Freeboard** – Freeboard in the collection system is defined as the depth between the grade or rim elevation and the hydraulic grade line (HGL).
3. **Hydraulic Loading Ratio (HLR)** – The hydraulic loading ratio within each sewer under peak flow conditions is a commonly used as a metric to evaluate the performance of open channel flow sewers. The HLR is mathematically defined as the peak flow divided by the full pipe capacity (calculated using Manning's Equation), and it is denoted as "Max/Full Flow" in the simulation results.
4. **Residual Capacity** – The residual capacity within each sewer when subjected to peak flows equates to the difference between full pipe capacity and the peak flow. This performance indicator is useful in illustrating the relative remaining capacity throughout the system.

The City's LOS criteria for the collection system are based on the allowable surcharge (or minimum freeboard) within the gravity portion of the collection system. The maximum allowable surcharge in the gravity portion of the sanitary sewer system is assessed using the estimated HGL elevation of wastewater in the pipelines. The HGL must remain at least 8-feet from the ground surface during peak flow conditions (i.e. at least 8-feet of minimum freeboard is required).

This is the criteria established within the City's Wastewater Master Plan. Existing sewers with depths greater than 8-feet have been said to be within LOS criteria if the peak surcharge elevation results in a freeboard of greater than 8-feet with less than one foot of HGL surcharging above the pipe crown. Any sewers identified with freeboard less than 8-feet are considered deficient should any surcharging above the pipe crown result.

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Thus, the identified deficiencies are generally based upon the following criteria:

1. Minimum freeboard of 8-feet (HGL depth below grade/rim)
2. Surcharging less than 1-foot above the pipe crown (with freeboard of 8-feet or greater)
3. No surcharging (with freeboard of less than 8-feet)

4.2 PREVIOUS MODEL RESULTS

The sewer capacity assessments are performed using the simulated results from modeled scenarios and the City's LOS criteria. A summary of relevant model results and capacity constraints identified in the Master Plan and the two Project Alternatives are described herein. HGL profiles that are relative to the Dorsey Marketplace and the downstream collection system were provided in TM No. 1.

4.2.1 Wastewater System Master Plan & TM No. 1: Results Summary

City of Grass Valley Wastewater System Master Plan

A summary of relevant model results from the Master Plan have been presented in TM No. 1. The HGL profiles of specific relevance to the Dorsey Marketplace project are shown in Exhibit C of TM No. 1 (Attachment 1). The City's Master Plan identifies capacity issues within the City's collection system under design storm (peak flow) conditions. The portions of the collection system that are specifically relevant to the Dorsey Marketplace development include the assessment of the Idaho Maryland Trunk and the portion of the Main Trunk between the Idaho Maryland Trunk and the City's WWTP. The Springhill Drive sewer collector was not considered within the Master Plan and was added to the model and considered with the assessment of Alternative A and Alternative B.

The Idaho Maryland Trunk extends along Idaho Maryland Road to East Main Street, where it connects to the City's Main Trunk sewer. The Master Plan identifies manholes in which the HGL failed to meet the City's LOS criteria. The location of these capacity constraints is upstream of the point of connection of the Springhill sewer collector, which is proposed to convey flow from the Dorsey Marketplace development. Sanitary Sewer Overflows (SSO) are predicted to occur in this upstream reach of the system with the addition of flow from long-term growth. Despite being upstream of the portion of the collection system considered as part of this assessment, eliminating these capacity constraints will increase peak flows in the downstream collection system. Collection system capacity improvements along the Idaho Maryland Trunk upstream of Springhill Drive would allow a higher rate of flow from portions of the system where flow is currently attenuated flow and impact the portion of the trunk considered in this assessment. In addition to the upstream capacity issues, there is also a constraint where the Idaho Maryland Trunk meets the Main Trunk.

The Master Plan also identifies capacity constraints along the City's Main Trunk, specifically in the twin 18-inch sewers crossing underneath Highway 20. There was predicted to be a minimum freeboard of greater than 20 feet under existing conditions. It is noted that this capacity constraint will only worsen as capacity improvements and expansions occur in the upstream system.

Dorsey Marketplace Project TM No. 1 – Sewer Capacity Assessment

TM No. 1 identified two major areas of concern within the collection system, downstream of the Dorsey Marketplace development.

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

1. The twin 18-inch sewers crossing underneath Highway 20 identified in the Master Plan have insufficient capacity and cause LOS failures at development scenarios beyond existing conditions.
2. Where the Idaho Maryland Trunk meets the Main Trunk at the intersection of Idaho Maryland Road and East Main Street capacity limitations cause backwater effects along both trunks, including LOS failures under development scenarios under the long-term growth scenario and beyond.

4.3 ALTERNATIVE B SITE PLAN MODEL RESULTS

The hydraulic models of the City's collection system were adjusted to reflect the conditions of the Alternative B site plan. The Alternative B site plan adds approximately 25,000 gpd to the wastewater flow estimate generated for the Alternative A site plan.

4.3.1 Existing + Dorsey Marketplace Development (Alternative B)

This modeled scenario assesses the impact of a design storm event (10-year, 24-hour) on the existing collection system with the addition of flows from the proposed development. The peak flow experienced at the WWTP is the same as that of Alternative A, 13.7 MGD. The additional flow associated with the Alternative B site plan is attenuated in the upstream system, exacerbating upstream deficiencies.

The following provides a summary of surcharging in the system under design storm conditions for this scenario.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

In this scenario there is expected to be no surcharging along the Idaho Maryland Trunk, as was predicted in the original assessment of Alternative A

Main Trunk (from Idaho Maryland Road to the WWTP)

Model results predict that there will be no additional sewer surcharged in this profile when compared to the results presented for Alternative A. Surcharging in manhole I17-7 increases by only 0.01 feet.

Springhill Drive

There are not expected to be any sewers surcharge in this profile. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

There are not expected to be any LOS failures under this scenario.

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4.3.2 Existing + Development of Vacant Parcels + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system when all remaining vacant parcels within City Limits are developed, in addition to the Dorsey Marketplace (Alternative B). It is predicted that under these conditions a peak flow of 15.26 MGD would be experienced at the WWTP. Increasing by 0.025 MGD when compared to that of Alternative A, the amount of additional flow proposed by the alternative.

The following provides a summary of surcharging in the system under design storm conditions for this scenario.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

In this scenario there is expected to be minor surcharging along the Idaho Maryland Trunk, as was predicted in the original assessment of Alternative A. Surcharging is predicted to reach 0.39 feet at manhole N13-10, the first manhole upstream of the confluence of the Idaho Maryland and Main Trunk sewers. Surcharging increases by 0.02 feet when compared to that of Alternative A. The sewer remains within the City's LOS criteria having a minimum freeboard of 9.73 feet and a surcharge depth of less than 1-foot.

Main Trunk (from Idaho Maryland Road to the WWTP)

Model results predict that surcharging in manhole I17-7 will reach 1.60 feet with the addition of flow from vacant parcels and that of the proposed development. The surcharge depth exceeds the LOS limit of 1-foot in this scenario, as was predicted under Alternative A. Surcharge depth is predicted to increase by 0.01 feet when compared to the results for Alternative A. Freeboard

Springhill Drive

There are not expected to be any sewers surcharge in this profile, under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 3**.

Table 3 LOS Deficiencies Existing + Vacant + Dorsey Marketplace

| Model Results | Alternative A | Alternative B |
|------------------------|----------------------|----------------------|
| Manhole | I17-7 | I17-7 |
| Depth (feet) | 22.76 | 22.76 |
| Freeboard (feet) | 19.18 | 19.16 |
| Surcharge Depth (feet) | 1.59 | 1.60 |

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update**4.3.3 Near-term Development + Dorsey Marketplace (Alternative B)**

This scenario simulates the impact of a design storm on the existing collection system upon development of areas identified as near-term growth in the City's Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The near-term growth scenario (~5-years) includes a portion of the "Loma Rica Special Development Area", lands west of Brunswick Road, north of Idaho Maryland and east of Sutton Way. It also includes a portion of the Berriman Ranch and adjacent properties.

Under these conditions, it is predicted that the WWTP will experience a peak flow of 16.5 MGD, assuming no capacity improvements are made within the existing collection system. This peak flow was also predicted to occur under Alternative A conditions when rounded. Increasing from 16.48 to 16.52 MGD from Alternative A to Alternative B. The inclusion of additional flow from Alternative B is not predicted to cause any additional sewer segments to become surcharged when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under near-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results for Alternative B predict surcharging will occur in manhole N13-10, reaching a depth of 0.95 feet. This scenario increases surcharge depth by 0.02 feet when compared to the results of Alternative A. This manhole remains within LOS criteria with minimum freeboard of 9.18 feet.

Main Trunk (from Idaho Maryland Road to the WWTP)

Surcharging in manhole I17-7 is further exacerbated with the inclusion of flow from near-term development. The surcharge depth is estimated to reach 2.35 feet above the pipe crown. The Alternative B site plan increases the surcharge depth at this manhole by 0.03 feet when compared to the results of Alternative A. Although the minimum freeboard is predicted to be 18.41 feet, this manhole fails to meet the City's LOS criteria due to the surcharge depth.

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 4**.

Table 4 LOS Deficiencies Near-term Development + Dorsey Marketplace

| Model Results | Alternative A | Alternative B |
|------------------------|---------------|---------------|
| Manhole | I17-7 | I17-7 |
| Depth (feet) | 22.76 | 22.76 |
| Freeboard (feet) | 18.44 | 18.41 |
| Surcharge Depth (feet) | 2.32 | 2.35 |

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update**4.3.4 Long-term Development + Dorsey Marketplace (Alternative B)**

This scenario simulates the impact of a design storm on the existing collection system upon development of areas identified as long-term growth in the City's Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The long-term growth scenario (~10-years) includes full development of the "Loma-Rica Special Development Area".

Under these conditions, it is predicted that the WWTP will experience a peak flow of 17.3 MGD, assuming no capacity improvements are made within the existing collection system. The peak flow was predicted to be 17.2 MGD under Alternative A conditions, when rounded. The inclusion of additional flow from Alternative B is predicted to cause surcharge depth to exceed 1-foot at one additional manhole on the Idaho Maryland Trunk when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under long-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results predict surcharging will occur in manholes N13-10 and N13-3, reaching depths of 1.54 and 1.08 feet. This scenario increases surcharge depth in manhole N13-10 by 0.05 feet when compared to the results of Alternative A. Surcharge depth in manhole N13-3 is predicted to increase by 0.15 feet causing the surcharge depth to exceed the LOS threshold of 1.0 foot of allowable surcharge, when compared to the results of Alternative A. The minimum freeboard exceeds 8-feet in both manholes.

Main Trunk (from Idaho Maryland Road to the WWTP)

The most notable surcharging in the collection system downstream of Springhill Drive exists in the parallel 18-inch sewers crossing Highway 20. Surcharge depth is predicted to reach 3.08 feet in manhole I17-7, with a minimum freeboard of 18.44 feet. Alternative B increases surcharge depth by 0.02 feet at this manhole. The manhole immediately upstream of manhole I17-7 also fails to meet LOS criteria under the conditions of this development scenario. Surcharge depth in manhole I17-3 reaches 1.30 feet, increasing from 1.27 feet predicted for Alternative A. The minimum freeboard exceeds 14 feet in both manholes.

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 5**.

Table 5 LOS Deficiencies Long-term Development + Dorsey Marketplace

| Manhole ID | N13-10 | | N13-3 | | I17-7 | | I17-3 | |
|------------------------|--------|-------|-------|-------|-------|-------|-------|-------|
| Model Results | A | B | A | B | A | B | A | B |
| Depth (feet) | 11.38 | 11.38 | 11.15 | 11.15 | 22.76 | 22.76 | 16.68 | 16.68 |
| Freeboard (feet) | 8.66 | 8.61 | 8.99 | 8.83 | 18.46 | 18.44 | 14.17 | 14.15 |
| Surcharge Depth (feet) | 1.48 | 1.53 | 0.93 | 1.08 | 3.06 | 3.08 | 1.27 | 1.30 |

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

4.3.5 Build-out Development + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system upon development of all remaining vacant parcels, the areas identified within the near-term and long-term sphere of influence, and “build-out areas of concern” identified in the City’s Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The build-out growth scenario includes all additional lands identified within the City of Grass Valley 2020 General Plan, including the special development areas of North Star Ranch, Kenny Ranch, the balance of Berriman Ranch and adjacent properties, as well as all “areas of concern”.

Under these conditions, it is predicted that the WWTP will experience a peak flow of 25.9 MGD, assuming no capacity improvements are made within the existing collection system. The peak flow was predicted to be 25.8 MGD under Alternative A conditions, when rounded. The inclusion of additional flow from Alternative B is predicted to cause surcharge depth to exceed 1-foot at one additional manhole on the Idaho Maryland Trunk when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under long-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results predict surcharging will increase under buildout development conditions in manholes N13-10 and N13-3, reaching depths of 1.56 and 1.78 feet. This scenario increases surcharge depth in manhole N13-10 by 0.07 feet when compared to the results of Alternative A. Surcharge depth in manhole N13-3 is predicted to increase by 0.09 feet, when compared to the results of Alternative A. The minimum freeboard exceeds 8-feet in both manholes. Manhole N12-3 also fails to meet LOS criteria under buildout conditions, as predicted in the Alternative A assessment. Surcharge depth reaches 2.55 feet above the pipe crown, 0.17 feet higher than what was predicted for Alternative A. It should also be noted that further upstream, east of Highway 20, manholes O12-3 and O12-4 are predicted to just meet LOS criteria. Manhole O12-3 has a depth of 9.2 feet and less than 8-feet of available freeboard. Any additional flow would cause surcharging this manhole and would cause it to fail to meet LOS criteria. It should also be noted that the Idaho Maryland Trunk and tributary sewers upstream of Springhill Drive has severe capacity constraints. The model predicts that under buildout conditions approximately 1.26 MG will overflow from this portion of the sewer system during design storm conditions. Should these capacity constraints be resolved, more flow will be allowed to enter the downstream portion of the Idaho Maryland Trunk being considered in this TM, further exacerbating existing capacity constraints.

Main Trunk (from Idaho Maryland Road to the WWTP)

Surcharging is expected to worsen as a result of higher flows and limited capacity in the twin 18-inch sewers crossing Highway 20. The surcharge depths of manhole I17-7 and I17-3 are expected to increase to 4.16 feet and 2.81 feet respectively, increasing by 0.03 and 0.05 feet when compared to the results of Alternative A. Manhole J16-19, directly upstream of I17-7 and I17-3, is also predicted to fail LOS criteria under these conditions. In the assessment of Alternative A, manhole J16-19 was predicted to reach a surcharge depth of 1.75 feet. Surcharge depth increased to depth of 1.80 feet in the assessment of Alternative B. The manhole upstream of J16-19 is also predicted to fail LOS criteria under buildout conditions. Manhole J16-16 is predicted to have a surcharge depth of 1.98 feet under Alternative B, and 1.91 feet under Alternative A. As noted for the Idaho Maryland Trunk, upstream capacity restrictions cause sewer system overflows under buildout conditions. Improvements to these areas will cause higher flow rates to enter the downstream collection system considered in this TM.

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 6** and **Table 7**.

Table 6 Idaho Maryland Trunk LOS Deficiencies Build-out + Dorsey Marketplace

| Manhole | N13-10 | | N13-3 | | N12-3 | |
|------------------------|--------|-------|-------|-------|-------|-------|
| Model Results | A | B | A | B | A | B |
| Depth (feet) | 11.38 | 11.38 | 11.15 | 11.15 | 13.29 | 13.29 |
| Freeboard (feet) | 8.64 | 8.57 | 8.21 | 8.12 | 9.66 | 9.49 |
| Surcharge Depth (feet) | 1.49 | 1.56 | 1.69 | 1.78 | 2.38 | 2.55 |

Table 7 Main Trunk LOS Deficiencies Build-out + Dorsey Marketplace

| Manhole | I17-7 | | I17-3 | | J16-19 | | J16-16 | |
|------------------------|-------|-------|-------|-------|--------|-------|--------|-------|
| Model Results | A | B | A | B | A | B | A | B |
| Depth (feet) | 22.76 | 22.76 | 16.68 | 16.68 | 10.96 | 10.96 | 11.35 | 11.35 |
| Freeboard (feet) | 16.63 | 16.60 | 11.92 | 11.88 | 7.21 | 7.16 | 7.44 | 7.37 |
| Surcharge Depth (feet) | 4.13 | 4.16 | 2.76 | 2.81 | 1.75 | 1.80 | 1.91 | 1.98 |

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5.0 SUMMARY OF ALTERNATIVES & SEWER CAPACITY IMPACTS

The purpose of this section is to present a summary of the sewer capacity assessment results presented in the previous section of this TM in comparison to those presented in TM No. 1 for the original Dorsey Marketplace site plan (Alternative A).

There are two major areas of concern in the City's wastewater collection system downstream of the proposed Dorsey Marketplace development, the twin 18-inch sewers crossing under Highway 20 and the confluence of the Idaho Maryland Trunk and the Main Trunk. The twin 18-inch sewers have insufficient capacity and cause LOS failures at development scenarios beyond existing conditions. Where the Idaho Maryland and Main Trunk sewers meet, throttling occurs and causes LOS failures under the long-term growth scenario and beyond.

TM No. 1 defines the "percent responsible" to quantify the contribution of hydraulic loading from the Dorsey Marketplace development. The percentage of the peak flow attributable to the development above existing peak flow conditions (presented in the Master Plan), was calculated for the near-term and long-term scenarios. Manhole I17-7 is the only manhole that conveys Dorsey Marketplace flow and fails the City's LOS criteria under near-term development conditions, as predicted for the evaluation of Alternative A. The percent of peak flow attributable to the development was calculated as 12.6% in TM No. 1 for the Alternative A site plan. The Alternative B site plan adds an additional 0.25 MGD of flow to the Dorsey Marketplace wastewater flow estimate and increases this percent responsible to 13.7%.

The percent responsible is calculated by determining the amount of peak flow in the manhole that can be attributed to the Dorsey Marketplace. This value is then divided by the peak flow that can be attributed to near-term development.

Under the long-term development scenario, manholes I17-7, I17-3, and N13-10 failed to meet the City's LOS criteria, as presented in TM No. 1. The Alternative B site plan causes an additional LOS failure along the Idaho Maryland Trunk, when surcharge depth exceeds i-foot in manhole N13-3. The percent responsible in each of these manholes is presented in **Table 8**.

Table 8 Percent Responsible - Long Term Conditions

| Manhole | Percent Responsible Long Term | |
|---------|-------------------------------|---------------|
| | Alternative A | Alternative B |
| I17-7 | 11.8% | 12.7% |
| I17-3 | 11.2% | 12.1% |
| N13-10 | 15.5% | 16.7% |
| N13-3 | - | 16.7% |

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