Sacramento Regional County Sanitation District

Interceptor Sequencing Study

Technical Memorandum 15
Centralized, Scalping, and SatelliteTreatment Alternatives

August 2010

Sacramento Regional County Sanitation District

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TECHNICAL MEMORANDUM
NO. 15
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1.0 BACKGROUND AND INTRODUCTION

The Sacramento Regional County Sanitation District (SRCSD) is carrying out a high-level Interceptor Sequencing Study (ISS) to determine alternatives that would provide build-out regional sewer service for future expansion developments. Service to the areas of Folsom SOI, Eastborough, Glenborough, Aerojet, Westborough, Rio del Oro, Anatolia, Suncreek, Waegell and Cordova Hills were recognized as areas that were likely to start developing within the next 10 years. Therefore they would be studied in more detail under the Mid Range Planning (MRP) effort. However the ultimate (build-out) flows from these areas were considered in this ISS. Preliminary MRP investigations show that the flows from the "Aerojet Area", that is: Aerojet, Westborough, Rio del Oro, and Anatolia (see Figure 15.1) will ultimately connect to the existing Bradshaw Interceptor system via a connection on White Rock Road (that is, to Bradshaw 8 interceptor at Kilgore Rd). When and how they do this are matters for the MRP effort and so, although the flows from these areas are included in the calculations for future Bradshaw Interceptor flows, these areas were not considered further in the ISS.

In 2007, SRCSD completed a Water Recycling Opportunities Study (WROS). The WROS evaluated water recycling opportunities in 5 target areas throughout the Sacramento region, identified potential stakeholders, and evaluated 18 potential recycled water projects at a high level. The WROS recommended the implementation of the phase II expansion of the existing Water Reclamation Facility (WRF) at the SRWTP and performing more detailed feasibility studies on the other 3 most promising projects. The draft feasibility studies were completed in 2007.

The SRCSD now wishes to go beyond the WROS and the 3 feasibility studies to explore other potential water recycling alternatives that could be linked directly to the planned interceptor system. This technical memorandum will identify and evaluate recycled water projects or decentralized facilities that could reduce or eliminate the implementation of interceptor conveyance projects in the following general area (shown in Figure 15.1 to 15.4):

- The "East Area" (Suncreek, Waegell, Cordova Hills, Florin Road areas)
- The "Sheldon Area" (south of the East Area in the proximity of Sheldon Road, along Grantline Road)
- The "South Area" (south of the Sheldon Area and primarily Elk Grove)

The treatment alternatives for water recycling in these general areas will include analysis for discharge to surface waters such as the Cosumnes River.

Figure 15.1 ISS Service Areas

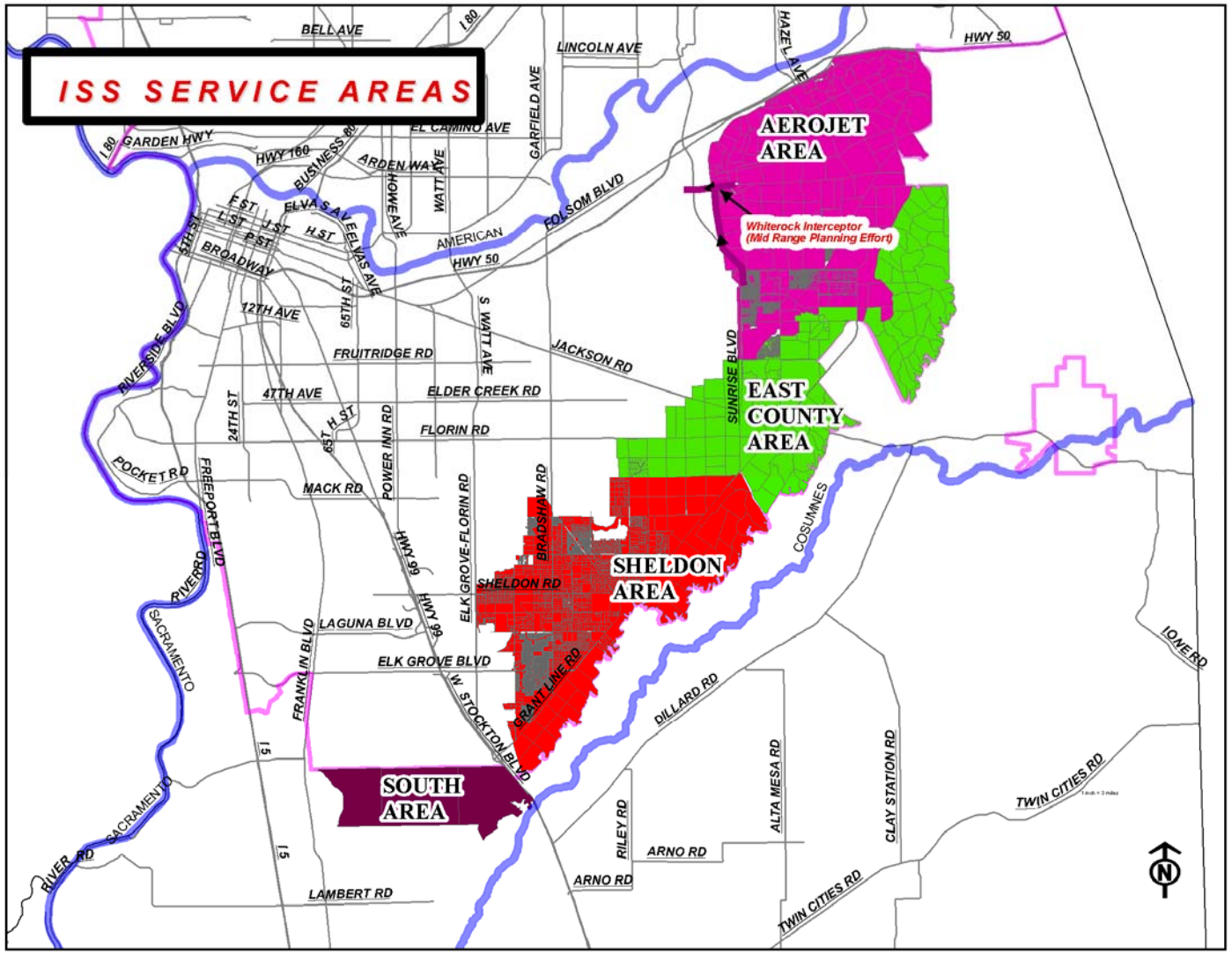


Figure 15.2 Satellite A – South Area

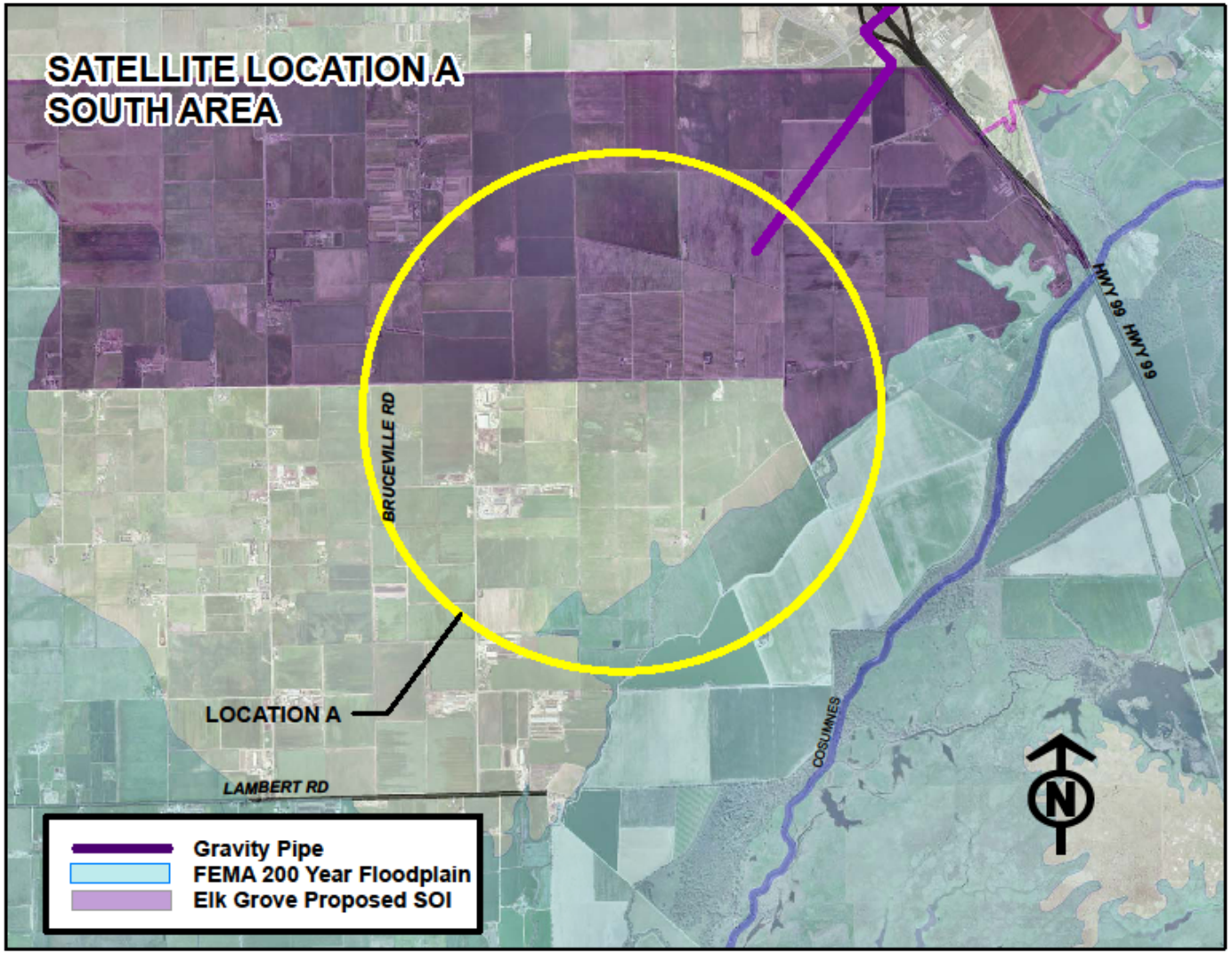


Figure 15.3 Satellite B – Sheldon Area

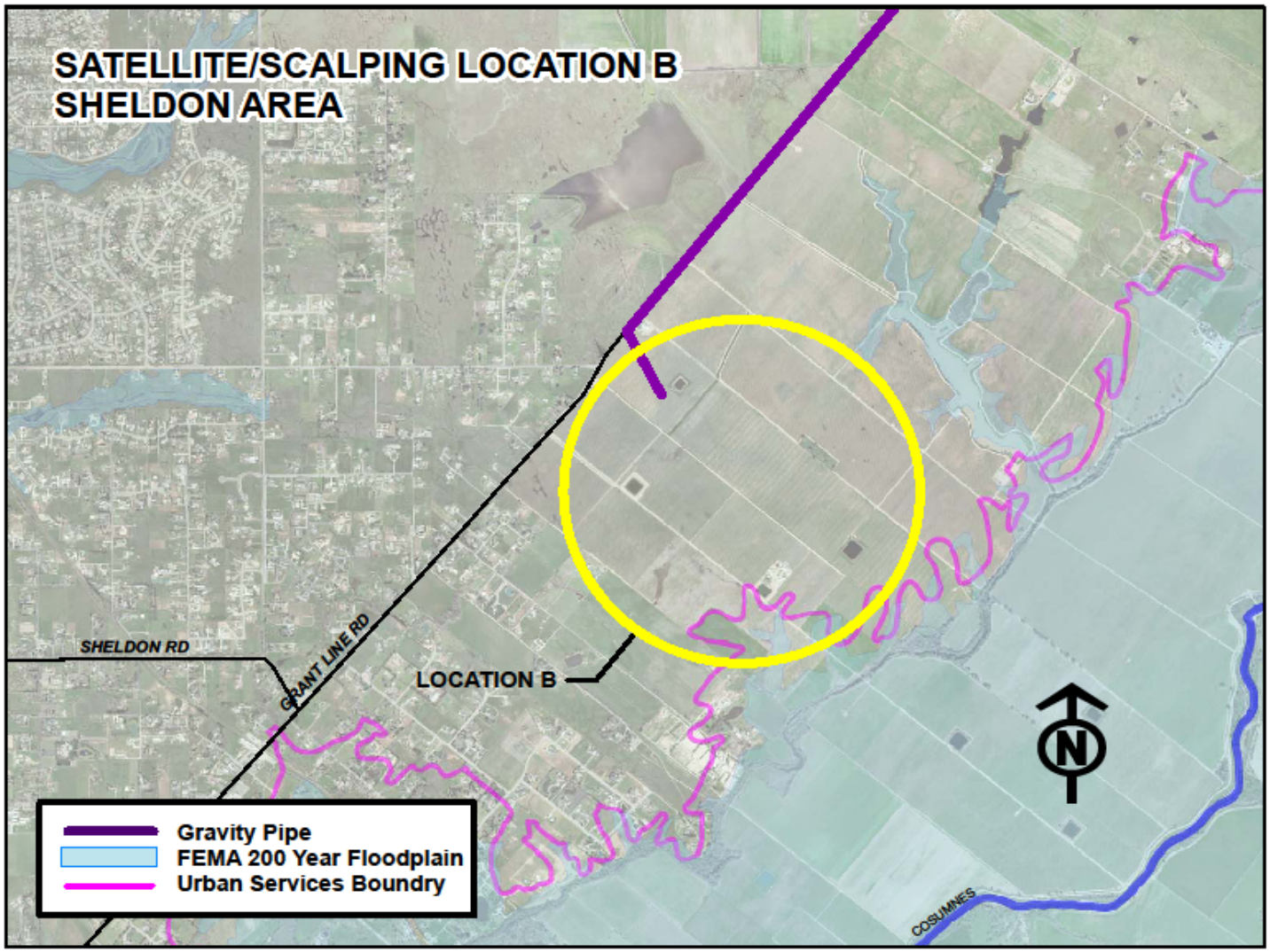
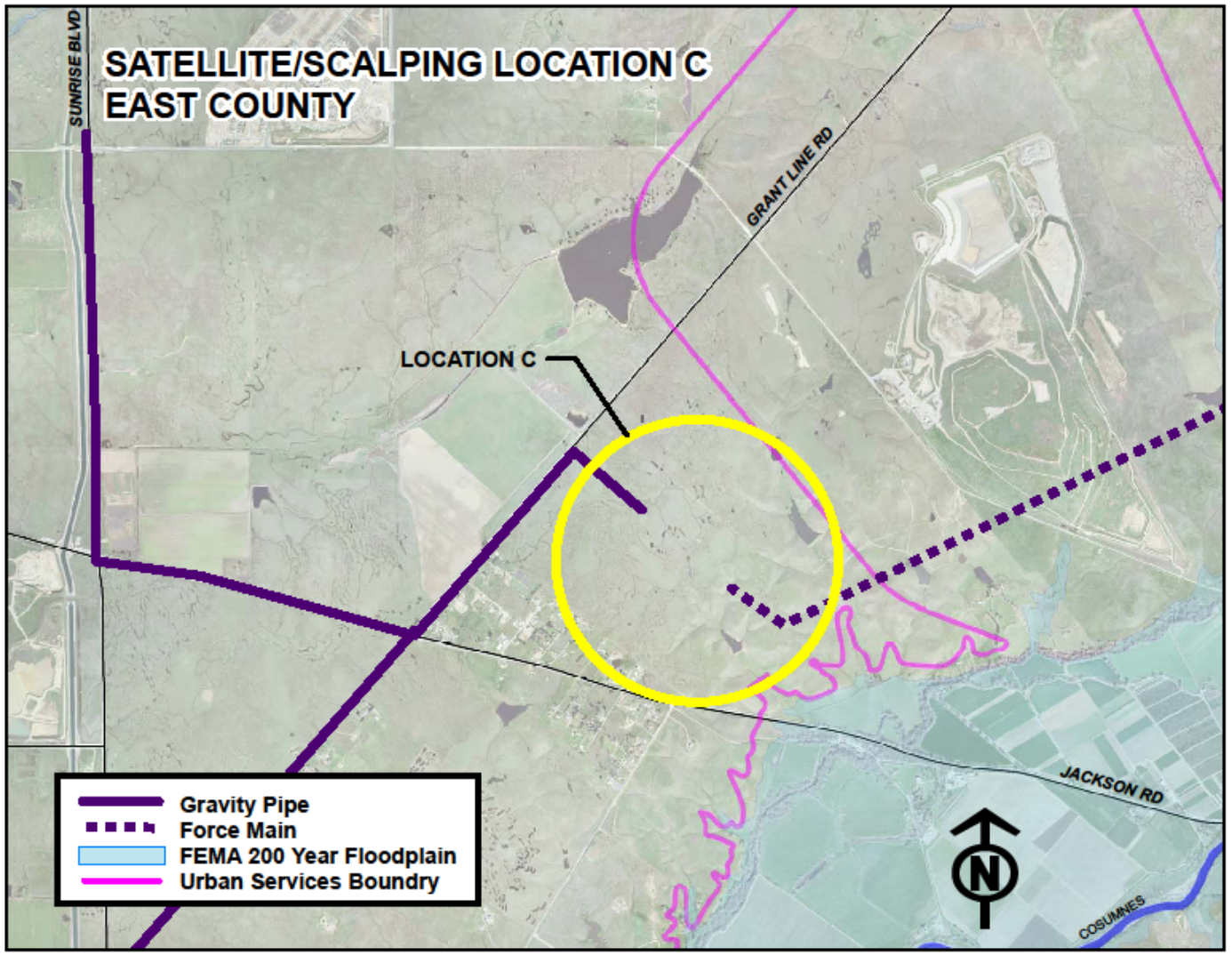


Figure 15.4 Satellite C – East County



2.0 REFERENCES

Table 15.1 Reference Documents	
Criteria Description	
Conveyance System Hydraulic Analysis	ISS TM 11 – Interceptor Conveyance Alternatives
Treatment Facility Unit Cost Analysis	ISS TM 9 – Unit Costs for Centralized, Scalping, and Satellite Wastewater Treatment Plants
Alternatives Life Cycle Cost Analysis	ISS TM 10 – Life Cycle Costs for Centralized, Scalping, and Satellite Facilities
Alternatives Risk Analysis	ISS TM 8 – Alternatives Risk Analysis

3.0 ANALYSIS CRITERIA OF ALTERNATIVES

3.1 Risk Analysis

An analysis of risk commonly identifies the risk of an event, analyzes the probability of failure and the consequence of failure, calculates a risk score, ranks the risk and develops risk mitigation strategies if required.

The methodology recommended for the ISS alternative analysis involves the following steps:

- Identify potential risk categories and corresponding failure events for each alternative.
- Determine a risk signature for each alternative.
- Evaluate alternatives based on project costs and risk signatures.
- Optional - Develop strategies to manage risk for preferred alternatives.

Detail of the risk analysis procedures used may be found in Technical Memorandum No. 8 (Risks Analysis), and risk signature for individual alternative can be found in Section 7.2 (Risk Analysis Summary) of this TM.

3.2 Cost Analysis

The total project cost estimate for each alterative in terms of net present value in 2010 dollar includes all capital cost and O&M cost over the life-cycle of 40 years but excludes the following:

- Value for remaining life of the assets including the conveyance system and decentralized treatment facilities.
- Cost saving for potential delay and/or elimination of capital improvement projects at SRWTP.
- Potential revenue from distribution of recycled water.

- Risk cost calculated using the criteria set out in Technical Memorandum No. 8 (Risks Analysis) is not included in the life-cycle cost analysis.

4.0 CENTRALIZED TREATMENT

The SRWTP is a secondary treatment facility with a permitted capacity of 181 mgd seasonal dry weather flow and includes on-site solids disposal facilities. The treatment train includes; aerated grit chambers followed by primary sedimentation; secondary treatment with high-purity oxygen activated sludge process and secondary clarifiers; and disinfecting process including chlorination/dechlorination basins. SRCSD also operates a Water Reclamation Facility (WRF) for tertiary treatment and the remaining flow is discharged to the Sacramento River.

Centralized treatment will be provided by a new or expanded Water Reclamation Facility at the SRWTP, which will provide Title 22 tertiary treatment of the secondary effluent produced by the SRWTP. The tertiary effluent (i.e. Recycled Water) is then transported from the SRWTP via distribution pipes to the point of discharge for the local system. Solid waste is treated on-site at the SRWTP.

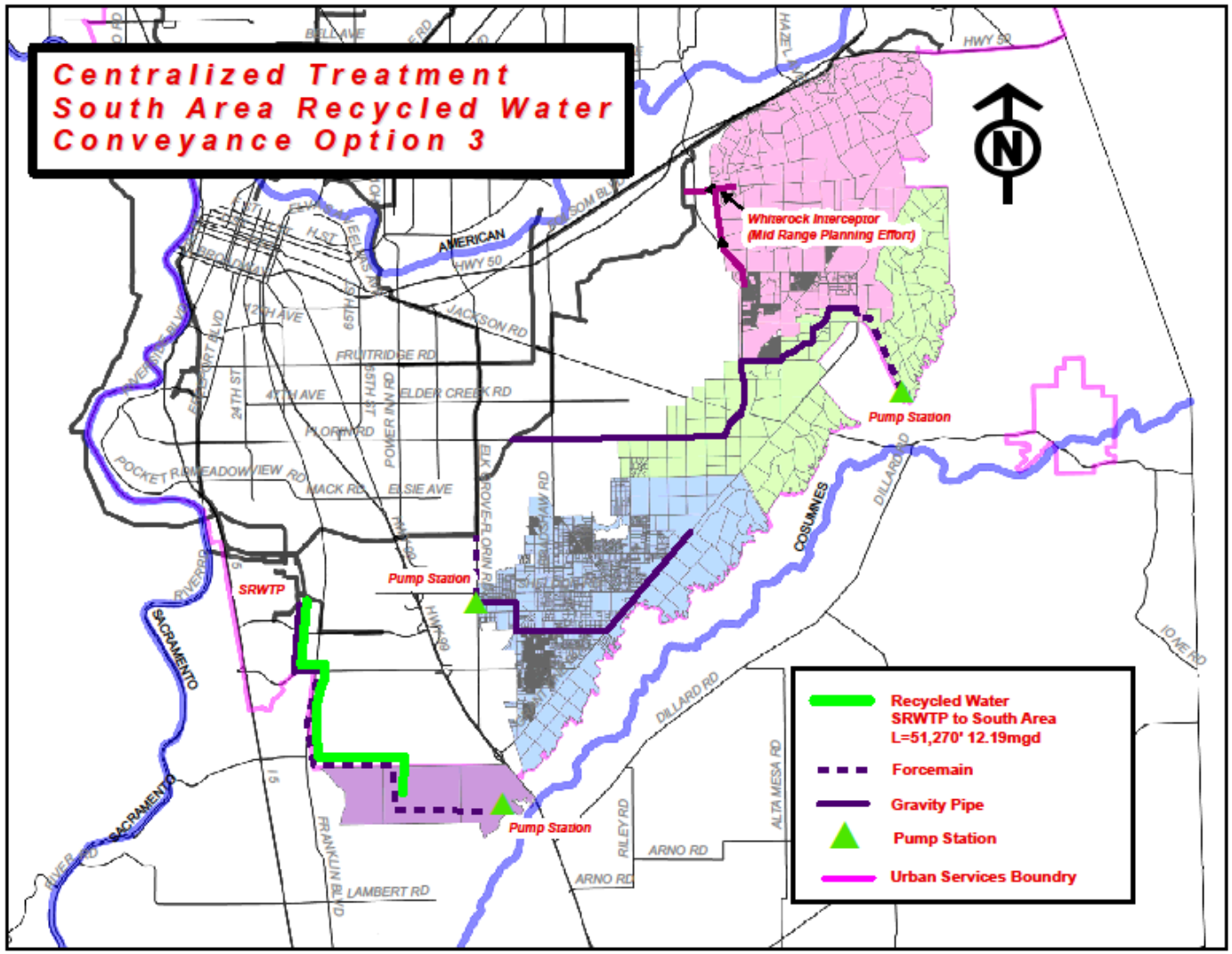
The advantage of centralized treatment is that it eliminates the need for an off-site facility, and that the WRF can be operated seasonally, producing recycled water for irrigation only during summer or dry months. The plant would not operate during wet months when the demand is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

4.1 South Area Recycled Water – Conveyance Option 3

(See Figure 15.5). The sewer conveyance option for this alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. The remaining, southern, Laguna/Grantline flows will be conveyed west, at first by gravity, toward the SRWTP (Sheldon Interceptor) along a corridor located on or near Sheldon Rd, but would then jog north, by pump station and force main, at Elk Grove-Florin Rd and connect to the Bradshaw Interceptor which will carry it on to the SRWTP (possible storage). Separately, the new South Interceptor in the expanded Elk Grove SOI will carry its flows north to the SRWTP via a pump station and force main.

A pumping facility would be constructed at the SRWTP to deliver 12 mgd of recycled water to the south area. Nine miles of new transmission pipline would deliver the water to a point where a local water provider could connect to their distribution system. This alternative has the lowest total cost ($874 million) among all centralized treatment alternatives but provides the least amount of recycled water.

Figure 15.5 South Area Recycled Water – Conveyance Option 3



4.2 Sheldon Area Recycled Water – Conveyance Option 3

(See Figure 15.6). Flow will be conveyed the same way to the SRWTP as described in Section 4.1. A pumping facility would be constructed at the SRWTP to deliver 16 mgd of recycled water to the sheldon area. Eleven miles of new transmission pipline would deliver the water to a point where a local water provider could connect to their distribution system. Total cost for this alternative is $958 million, $84 million more than the South Area recycled water option, but provides approximately 4 MGD extra recycled water capacity throughout the 40-year lifecycle of the analysis.

4.3 East County Recycled Water – Conveyance Option 3

(See Figure 15.7). Flow will be conveyed the same way to the SRWTP as described in Section 4.1. A pumping facility would be constructed at the SRWTP to deliver 34 mgd of recycled water to the East County area. Seventeen miles of new transmission pipline would deliver the water to a point where a local water provider could connect to their distribution system. Total cost for this alternative is $1.62 billion and is the highest among all centralized alternatives but provides the highest capacity (34.1 MGD) of recycled water to potential customers.

Figure 15.6 Sheldon Area Recycled Water – Conveyance Option 3

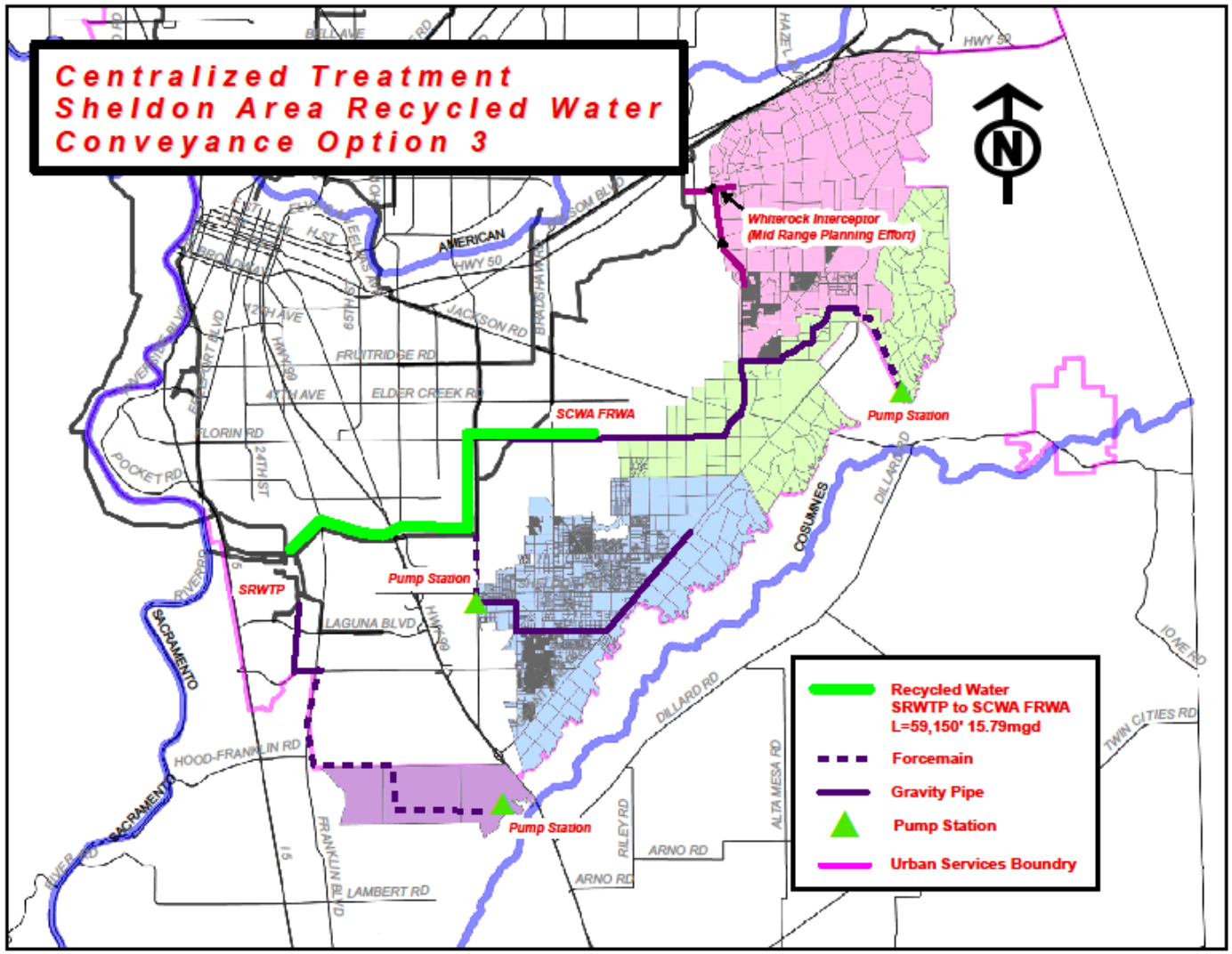
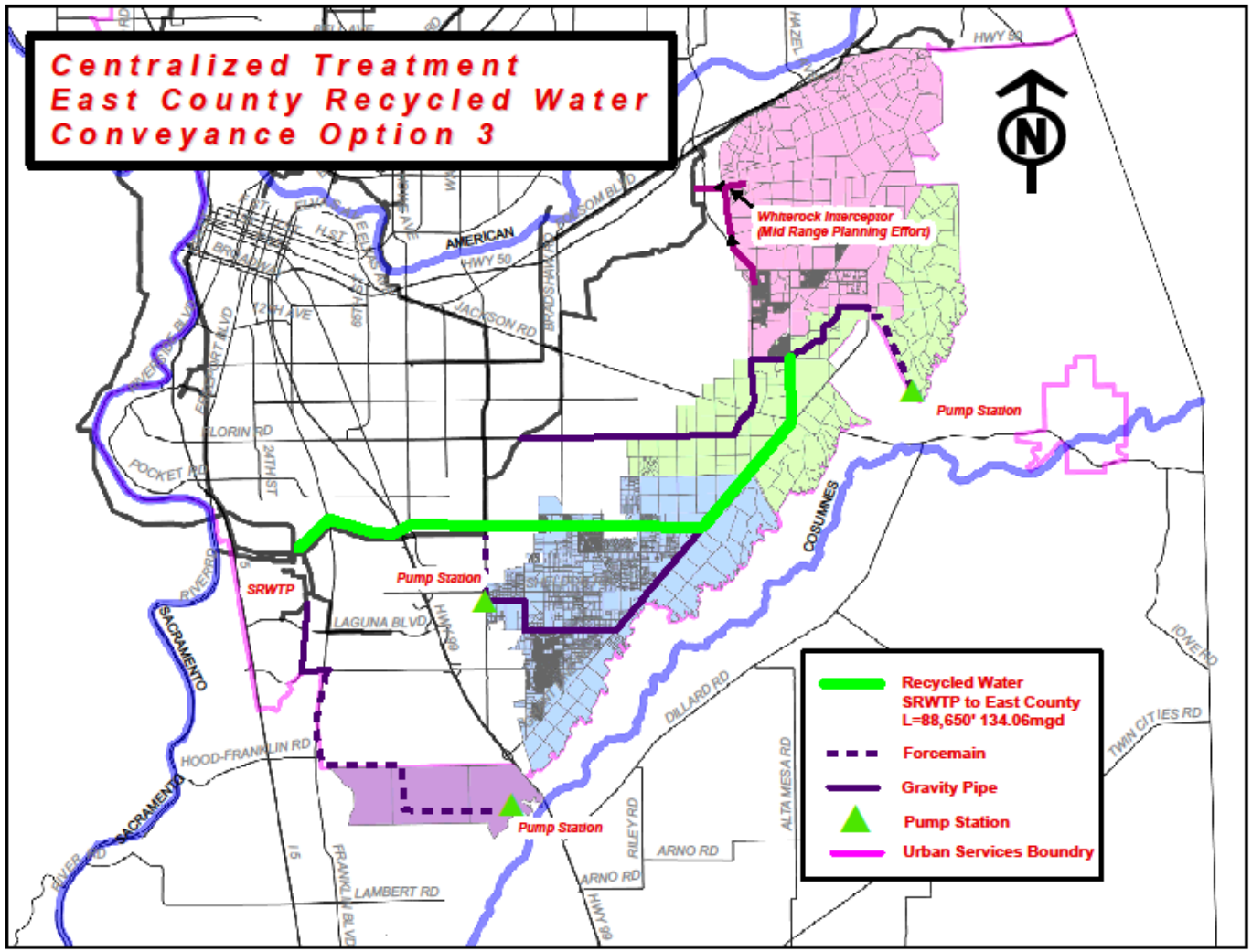


Figure 15.7 East County Recycled Water – Conveyance Option 3



5.0 SCALPI NG TREATMENT

A scalping plant is an MBR treatment facility located along a major interceptor sewer to treat wastewater generated from certain areas. These plants are typically placed in close proximity to water recycling opportunities, which significantly reduces the transmission costs of pumping treated wastewater from the SRWTP to the recycled water place of use. As would be expected, the transmission savings associated with building a satellite facility increase with the distance from the SRWTP.

Depending on the interceptor flow rate, the scalping facility can be designed to provide recycled water based on the demand pattern or based on a steady flow making the design flexible with minimal need of redundant units. This facility treats the "scalped" sewer flows, discharges the tertiary treated effluent to a local distribution system, and returns the solid waste back into the sewer collections system for standard treatment at the SRWTP.

A scalping plant can be operated seasonally, producing recycled water for irrigation during summer or dry months. The plant would not operate during wet months when the demand is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

5.1 Scalping A South Area

A satellite treatment facility in the South Area eliminates the need for the South Interceptor. Building the South Interceptor along with a scalping facility provides no advantages over building a satellite treatment facility in the South Area. The decision was made in a Leadership Meeting to not carry forward any scalping options for the South Area.

5.2 Scalping B Sheldon Area Option 1

(See Figure 15.8). The sewer conveyance option in this scalping alternative sends all the flows from the East County area and most of the Sheldon area to the Scalping B treatment plant via the Scalping B Interceptor. An assumption was made that the scalping facility will only operate for six months of the year when irrigation water is required. For those months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw interceptor system. The remaining flows south of this area would be conveyed using the Laguna/South Interceptor to the SRWTP. The Scalping B Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area and most of the Sheldon area, south to the scalping plant. The Laguna/South Interceptor takes flow by gravity to a pump station in Elk Grove which conveys the flows through a force main north-west to the SRWTP.

A recycled water transmission pipeline from the Scalping B treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie

in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 87 MGD, which is in the middle of the pack among all the scalping treatment alternatives. Total cost for this scalping alternative is $2.21 billion, which is the forth least expensive of all the scalping treatment alternatives.

5.3 Scalping B Sheldon Area Option 1A

(See Figure 15.9). The sewer conveyance option in this scalping alternative sends all the flows from the East County area and most of the Sheldon area to the Scalping B treatment plant via the Scalping B Interceptor. A return force main is being constructed to return flow to the interceptor system when the plant is not in operation. The remaining flows south of this would be conveyed by gravity to the Satellite a treatment plant using both direct pipelines from the surrounding Elk Grove SOI area and from the Satellite A Interceptor. The rest of the conveyance system is the same as the satellite treatment alternative.

Two recycled water transmission pipeline: one from the Scalping B treatment plant to a central location in the Sheldon area, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 129 MGD (87 MGD to Scalping B treatment plant and 42 MGD to Satellite A treatment plant A), which is the most among all the scalping treatment alternatives. However, the total cost for this scalping alternative is $2.85 billion, which is highest the among all the scalping treatment alternatives.

Figure 15.8 Scalping B Sheldon Area Option 1

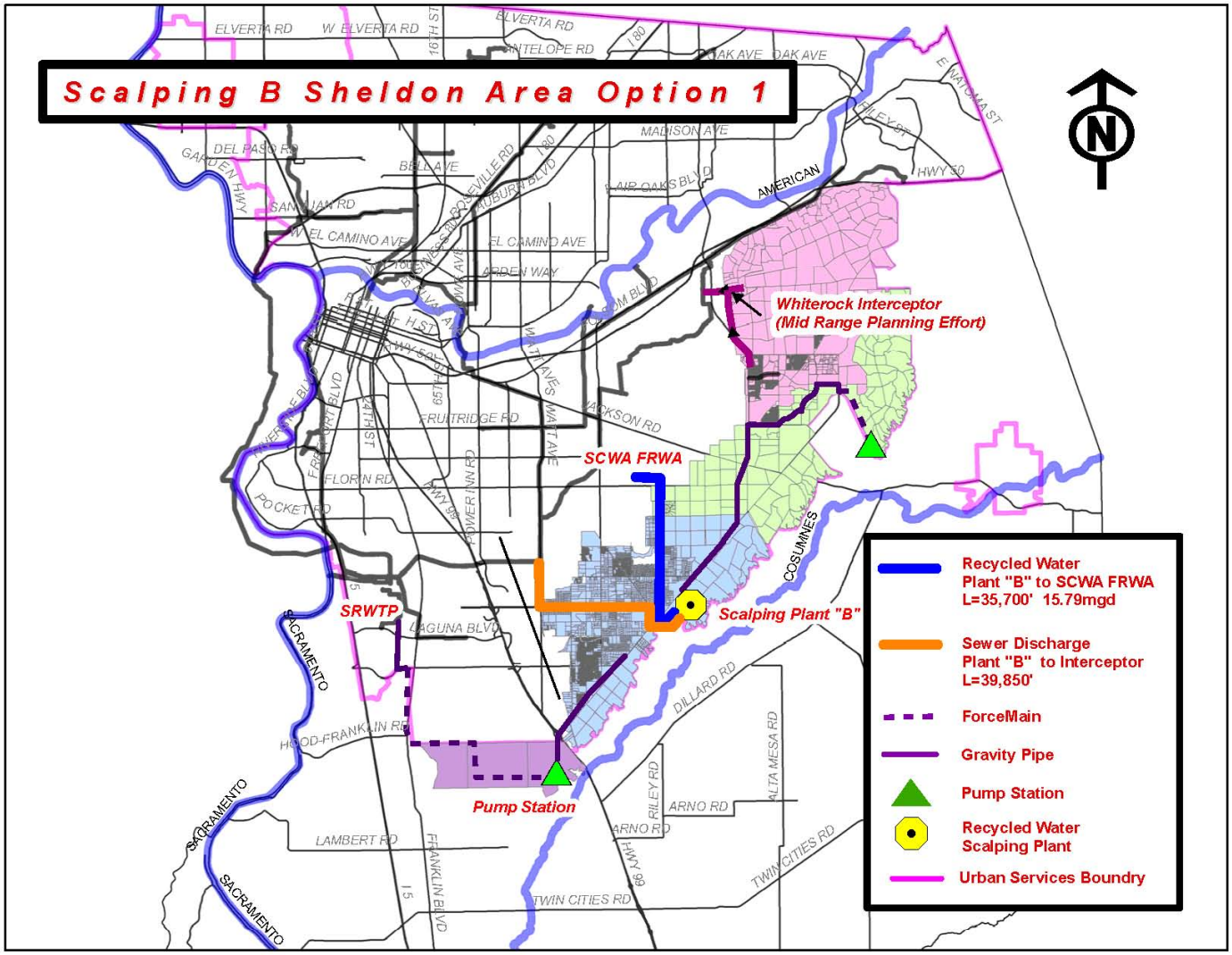
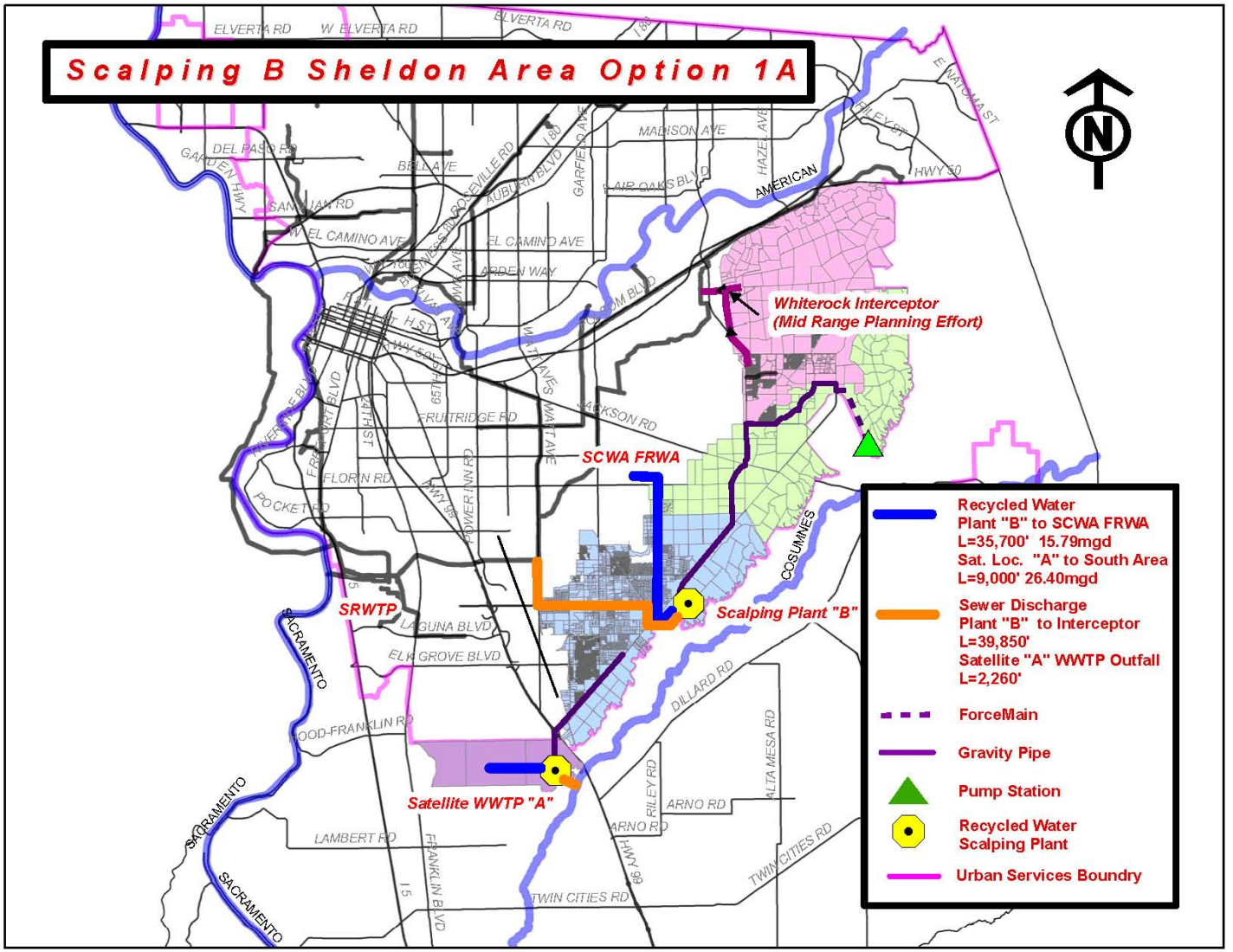


Figure 15.9 Scalping B Sheldon Area Option 1A



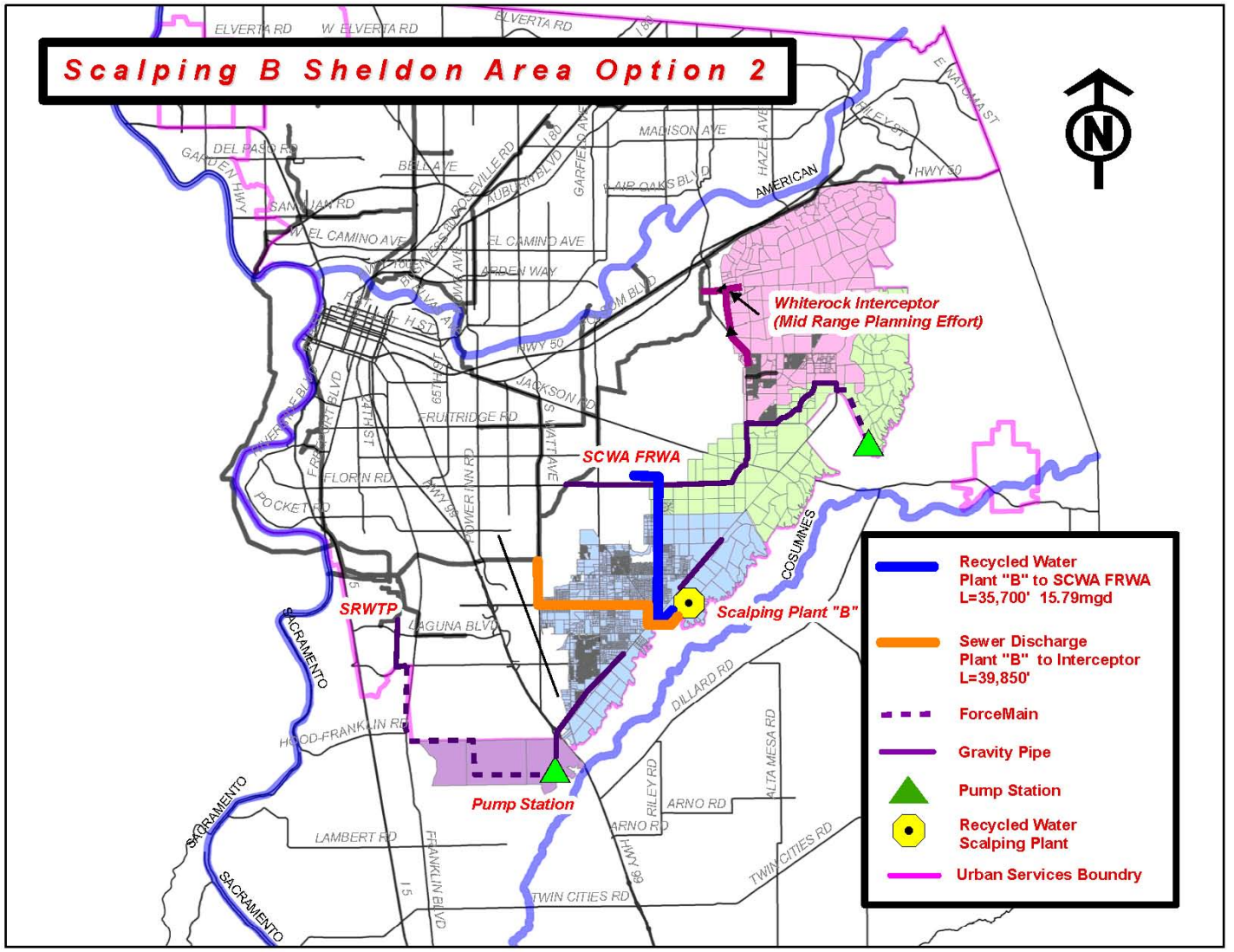
5.4 Scalping B Sheldon Area Option 2

(See Figure 15.10). The sewer conveyance option for this scalping alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. Separately, most of the Sheldon area, south of East County, is conveyed to the Scalping B treatment plant by gravity via the Scalping B Interceptor. An assumption was made that the scalping facility will only operate for six months of the year when irrigation water is required. For those months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw interceptor system. The remaining flows south of this area would be conveyed using the Laguna/South Interceptor to the SRWTP.

A recycled water transmission pipeline from the Scalping B treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to undergo decentralized treatment under this alternative is 35 MGD, which is least among all the scalping treatment alternatives. However, the total cost for this scalping alternative is $1.14 billion, which is lowest the among all the scalping treatment alternatives.

Figure 15.10 Scalping B Sheldon Area Option 2



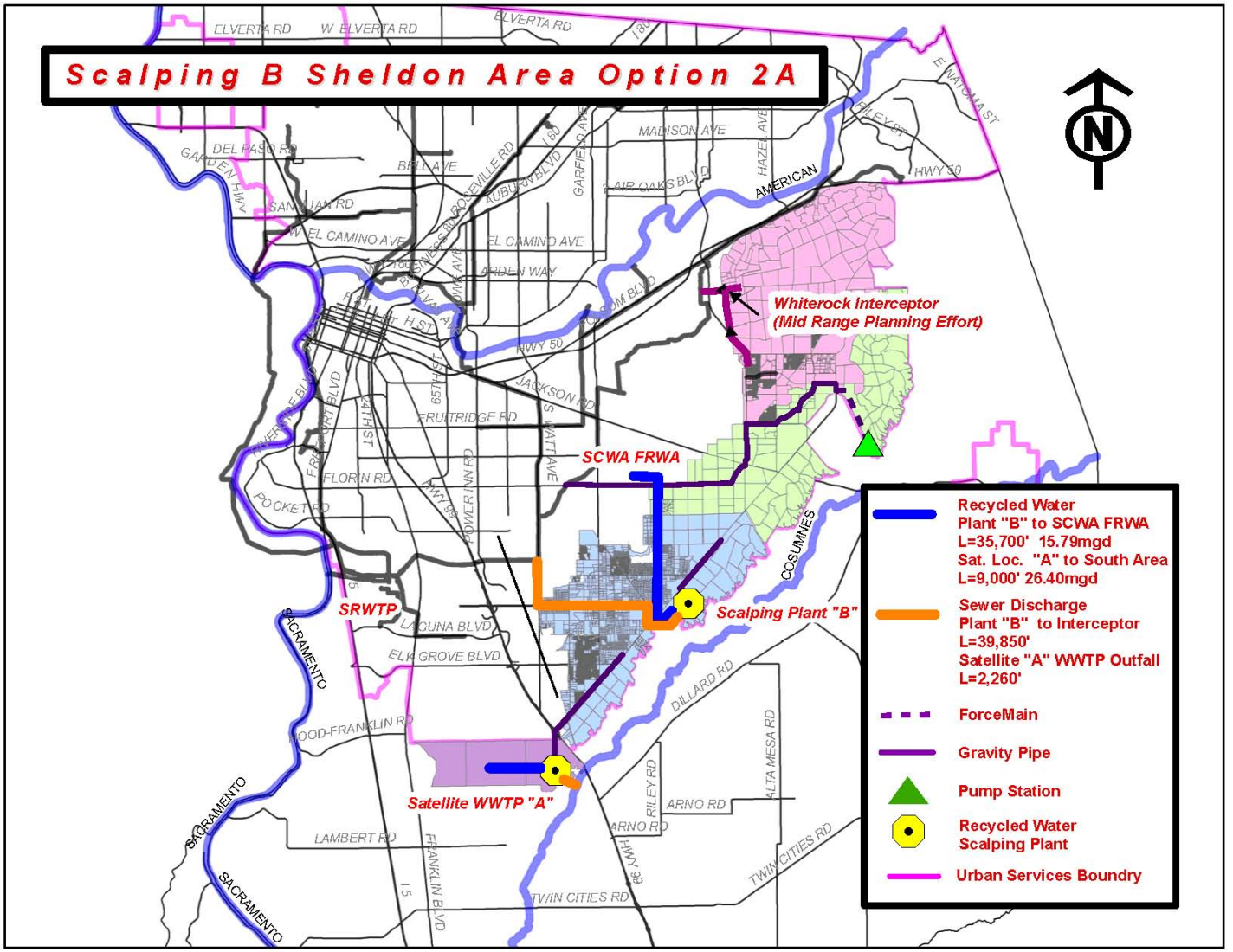
5.5 Scalping B Sheldon Area Option 2A

(See Figure 15.11). The sewer conveyance option for this scalping alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. Separately, most of the Sheldon area, south of East County, is conveyed to the Scalping B treatment plant by gravity via the Scalping B Interceptor. A return force main is being constructed to return flow to the interceptor system when the plant is not in operation. The remaining flows south of this would be conveyed using the Satellite A Interceptor to the Satellite A treatment plant. The rest of the conveyance system is the same as the satellite treatment alternative.

Two recycled water transmission pipeline: one from the Scalping B treatment plant to a central location in the Sheldon area, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 74 MGD, which is in the middle of the pack among all the scalping treatment alternatives. The total cost for this scalping alternative is $1.74 billion, which is the fourth highest total cost among all the scalping treatment alternatives.

Figure 15.11 Scalping B Sheldon Area Option 2A



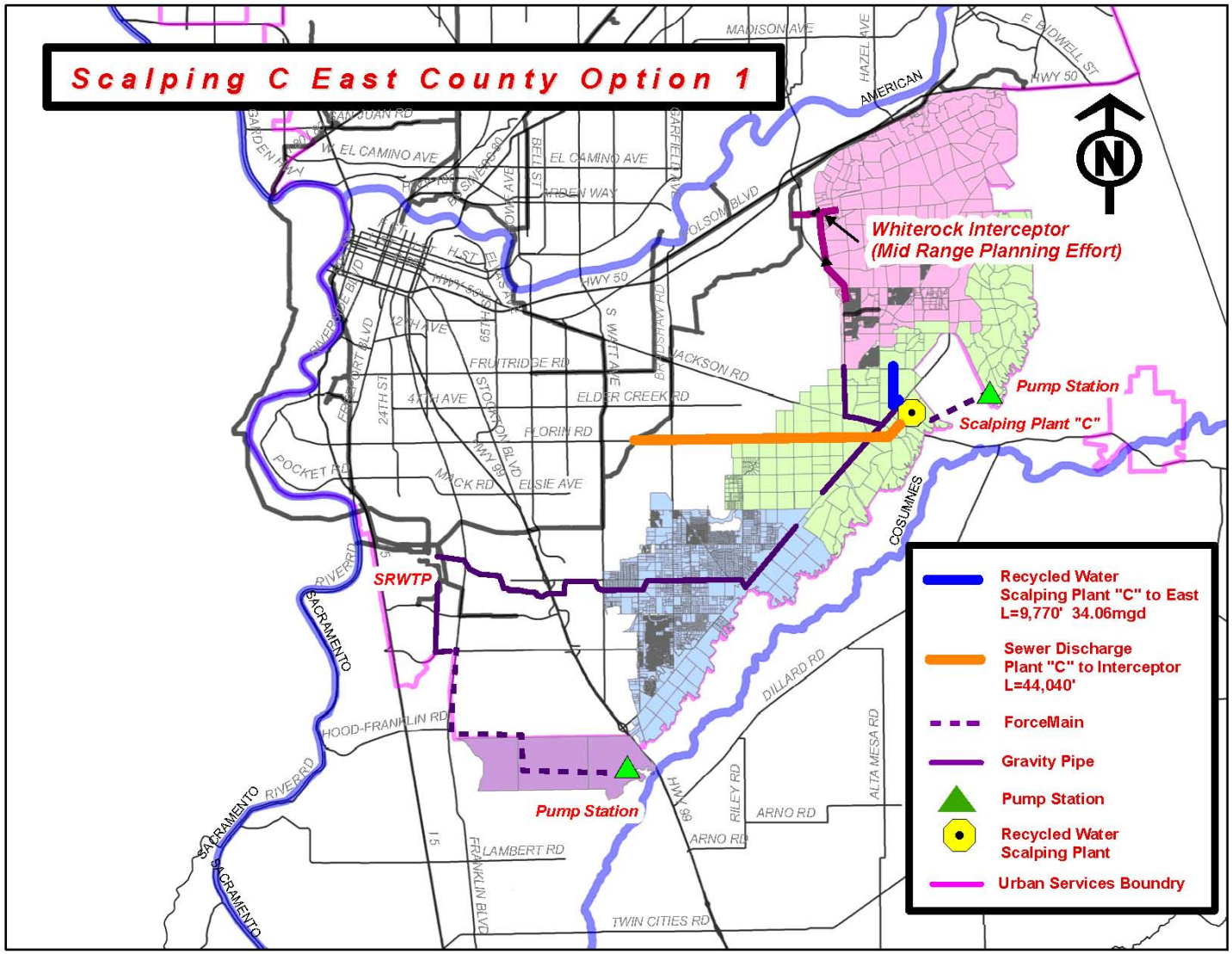
5.6 Scalping C East County Option 1

(See Figure 15.12). The sewer conveyance option of this scalping alternative sends all the flows from the East County area to the Scalping C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Scalping C Interceptor. An assumption was made that the scalping facility will only operate for six months of the year when irrigation water is required. For those months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw interceptor system. Separately, wastewater from the Sheldon area would be gravity fed west to the SRWTP via the Sheldon Interceptor. Finally the South Area flows (Elk Grove SOI) will be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

A recycled water transmission pipeline from the Scalping C treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 70 MGD, which is in the middle of the pack among all the scalping treatment alternatives. The total cost for this scalping alternative is $1.86 billion, which is the third lowest total cost among all the scalping treatment alternatives.

Figure 15.12 Scalping C East County Option 1



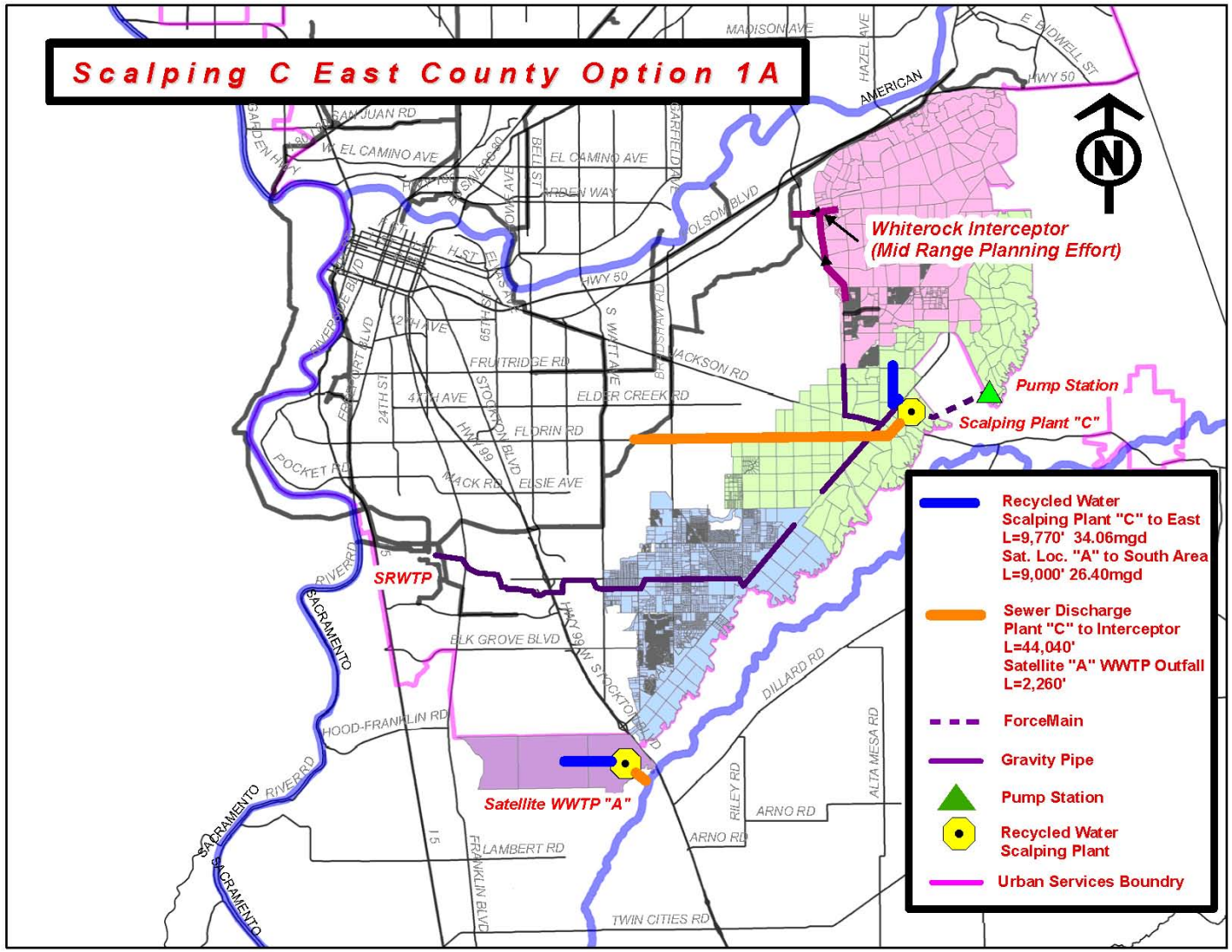
5.7 Scalping C East County Option 1A

(See Figure 15.13). The sewer conveyance option of this scalping alternative is similar to Option 1 except without the South Interceptor. It sends all the flows from the East County area to the Scalping C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Scalping C Interceptor. A return force main is being constructed to return flow to the interceptor system when the plant is not in operation. Separately, wastewater from the Sheldon area would be gravity fed west to the SRWTP via the Sheldon Interceptor. Finally the South Area flows (Elk Grove SOI) will be conveying directly to the Satellite A treatment plant.

Two recycled water transmission pipeline: one from the Scalping C treatment plant to a central location in the East County, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 97 MGD (70 MGD to Scalping C treatment plant and 26 MGD to Satellite A treatment plant A), which is the second highest among all the scalping treatment alternatives. However, the total cost for this scalping alternative is $2.06 billion, which is the second highest total cost among all the scalping treatment alternatives.

Figure 15.13 Scalping C East County Option 1A



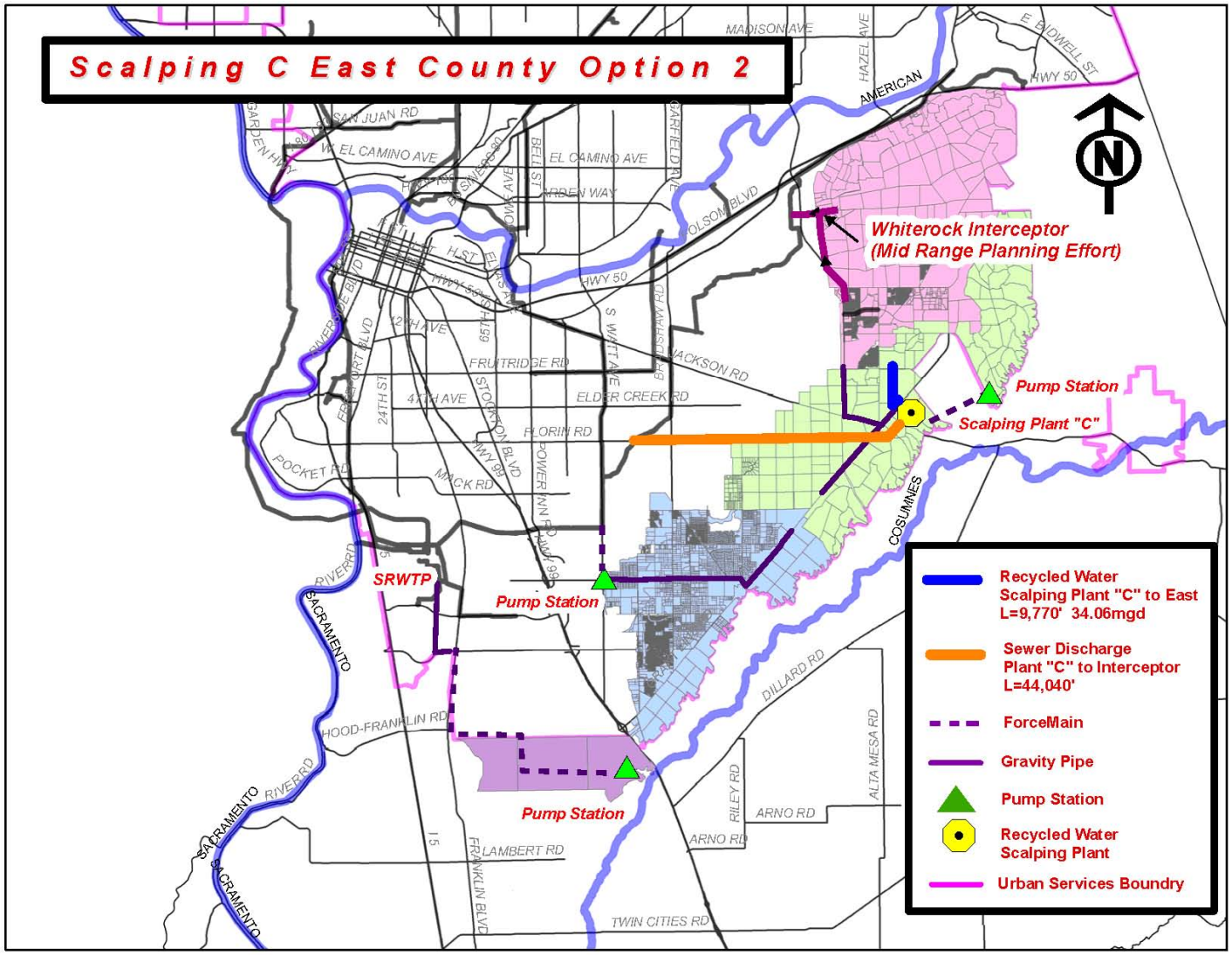
5.8 Scalping C East County Option 2

(See Figure 15.14). Similar to Option 1, the sewer conveyance option of this scalping alternative sends all the flows from the East County area to the Scalping C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Scalping C Interceptor. An assumption was made that the scalping facility will only operate for six months of the year when irrigation water is required. For those months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw interceptor system. Separately, wastewater from the Sheldon area would, at first, be gravity fed west, via the Sheldon Interceptor. But then, unlike Option 1, a 31 MGD pump station and force main will connect flows to the Bradshaw Interceptor on Elk Grove-Florin Road and takes them on to the SRWTP. Finally, the South Area flows (Elk Grove SOI) will be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

A recycled water transmission pipeline from the Scalping C treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 70 MGD, which is second lowest among all the scalping treatment alternatives. However, the total cost for this scalping alternative is $1.81 billion, which is the second lowest the among all the scalping treatment alternatives.

Figure 15.14 Scalping C East County Option 2



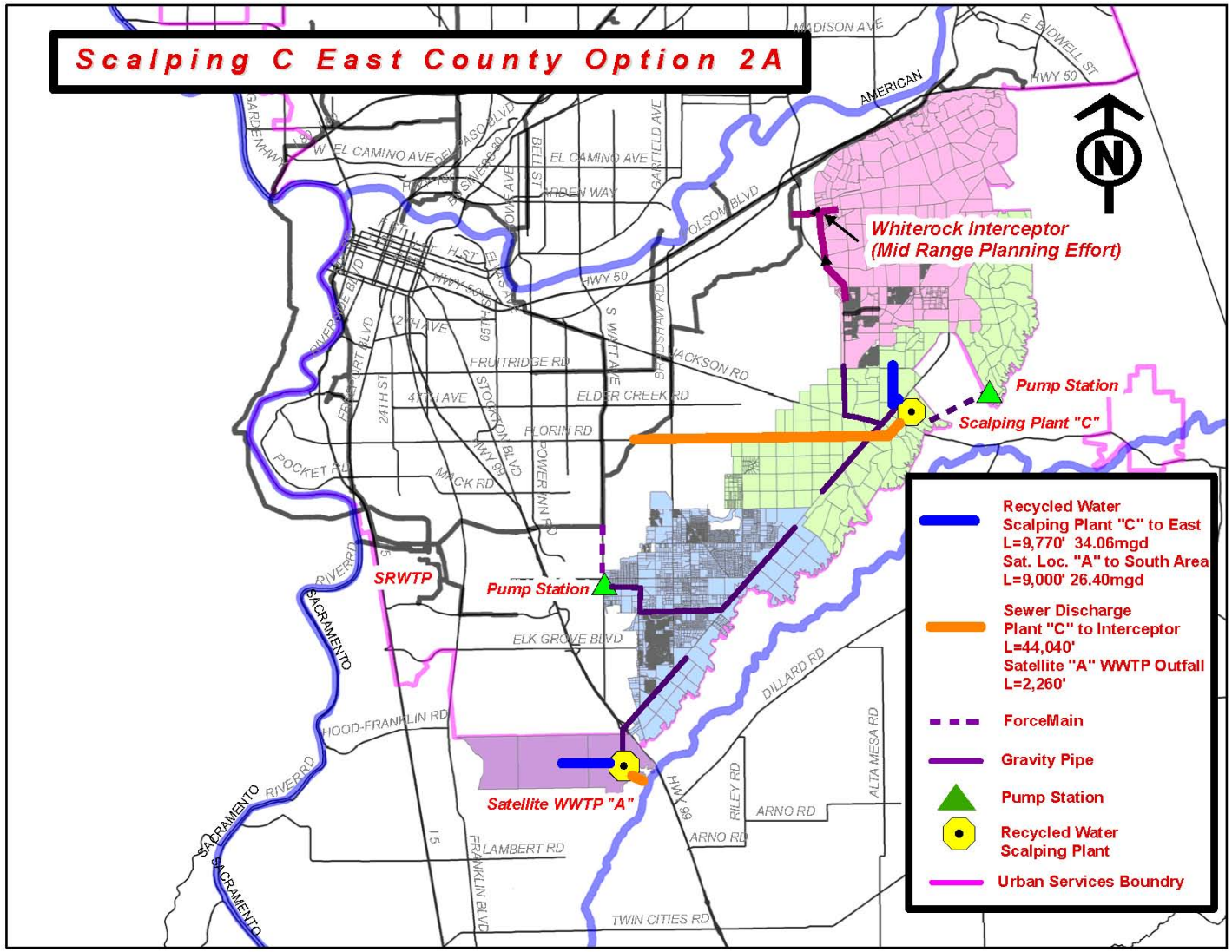
5.9 Scalping C East County Option 2A

(See Figure 15.15). The sewer conveyance option of this scalping alternative is similar to Option 2 except without the South Interceptor. It sends all the flows from the East County area to the Scalping C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Scalping C Interceptor. Separately, wastewater from the Sheldon area would, at first, be gravity fed west, via the Sheldon Interceptor. Then a 31 MGD pump station and force main will connect flows to the Bradshaw Interceptor on Elk Grove-Florin Road and take them on to the SRWTP. Finally, the South Area flows (Elk Grove SOI) will be conveyed by gravity directly to the Satellite A plant via the Satellite A Interceptor.

Two recycled water transmission pipeline: one from the Scalping C treatment plant to a central location in the East County, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

The amount of flow sent to decentralized treatment under this alternative is 97 MGD, which is second highest among all the scalping treatment alternatives. However, the total cost for this scalping alternative is $2.05 billion, which is the third highest among all the scalping treatment alternatives.

Figure 15.15 Scalping C East County Option 2A



6.0 SATELLI TE TREATMENT

A satellite plant is a MBR treatment facility that treats all influent flows and consistently produces acceptable water quality. As a result, sufficient reliability must be installed to allow for one or more membrane basins to be out of service and still maintain sufficient capacity to treat the influent flow under all conditions. This “end of pipe” treatment facility must accommodate the flow fluctuation from both diurnal flow and peak flows by either installing larger treatment units or by adding equalization tanks. Solid waste is treated on-site at the satellite facility or trucked back to the SRWTP for treatment. It also requires a discharge permit for excess flows and solid handling processes, which makes them less desirable in neighborhood locations due to its footprint.

The advantage of treating solids on-site is that it eliminates the need for an extensive network of interceptor pipes connecting to the SRWTP.

6.1 Satellite A South Area Option 1

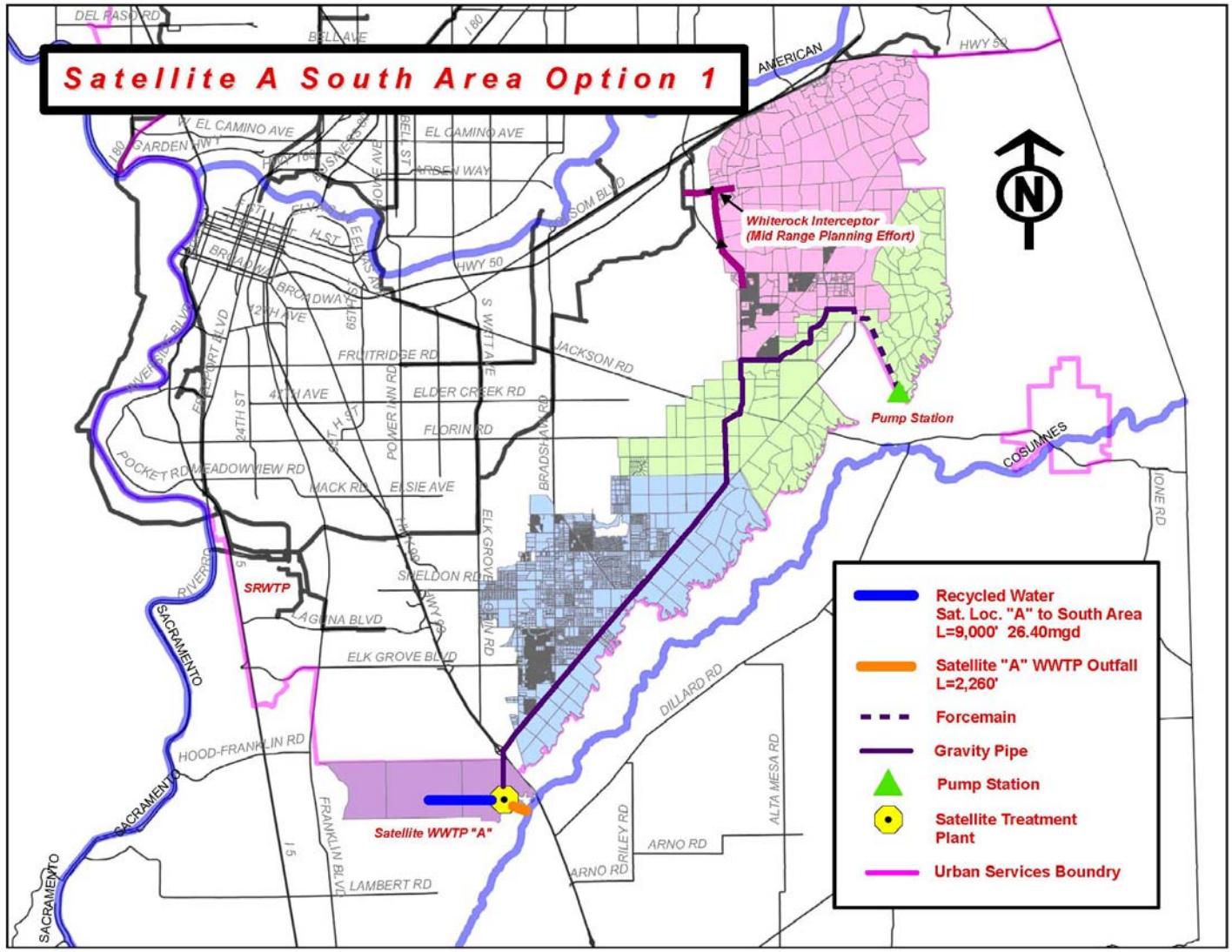
(See Figure 15.16). The sewer conveyance option for this satellite alternative takes the flows from all three areas (East County, Sheldon and South) and pipes them down to the Satellite A Plant in Elk Grove without diverting any to the Bradshaw Interceptor. This means that up to 121 MGD could be received by Satellite A for treatment. This conveyance system consists of one interceptor (the Satellite A Interceptor) which begins with a 20 MGD pump station that conveys all the Cordova Hills flows, via force main, over to the Suncreek/Waegell area where the gravity portion begins and continues south-west (parallel to Cosumnes River) to the Satellite A plant, picking up all remaining flows at it goes.

A recycled water transmission pipeline from the Satellite A treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With only 24 miles of pipeline and one 20-MGD pump station, the capital cost for the conveyance system is the least expensive among the three Satellite A alternatives; however, adding in the capital cost for the 121-MGD satellite treatment facility in Elk Grove area makes this alternative the second most expensive among the satellite treatment alternatives. Under this alternative, 121 MGD of wastewater will be conveyed to the satellite treatment facility, which is the second highest among all the satellite treatment alternatives.

The proposed 121-MGD satellite treatment facility would require a number of local, state, and federal approvals. Detailed discussion on legal issues may be found in the attached TM prepared by Somach Simmons & Dunn. All alternatives with satellite treatment facilities will have to address the same legal issues identified in this TM.

Figure 15.16 Satellite A South Area Option 1



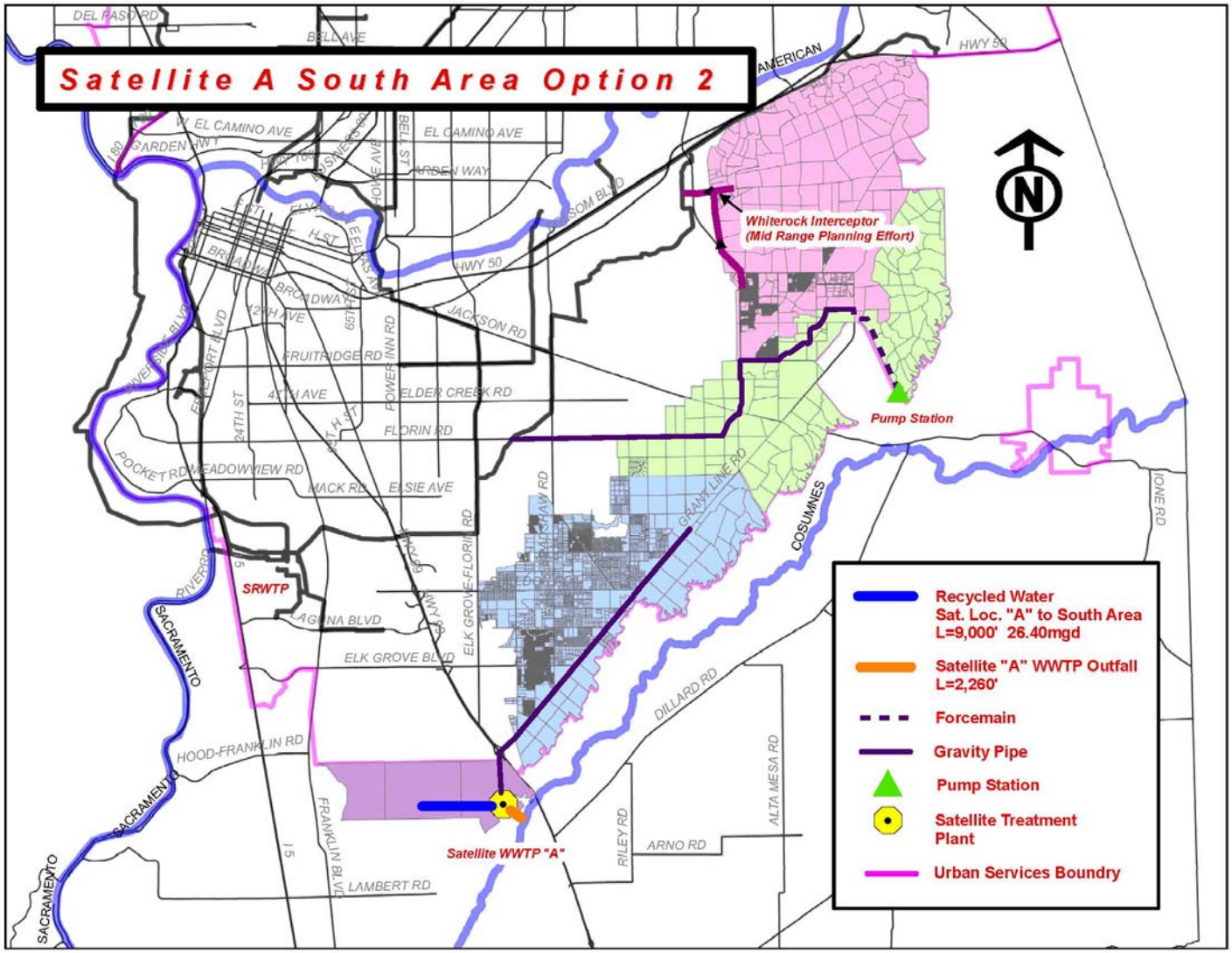
6.2 Satellite A South Area Option 2

(See Figure 15.17). The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor while conveying the remaining flows (from Sheldon and South areas) to the Satellite A Plant by way of the Satellite A Interceptor. The Florin Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area to the Bradshaw Interceptor via the Florin Road corridor. Separately, Satellite A Interceptor uses gravity to take all flows from the Sheldon area to Satellite A. Flows from the expanded Elk Grove SOI area flow directly to Satellite A via gravity.

A recycled water transmission pipeline from the Satellite A treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With 28 miles of interceptor pipeline, one pump station and a 71-MGD Satellite A treatment facility, this alterative has the third lowest total cost among all the satellite treatment alternatives. Under this alternative, 71 MGD of wastewater will be conveyed to the satellite treatment facility.

Figure 15.17 Satellite A South Area Option 2



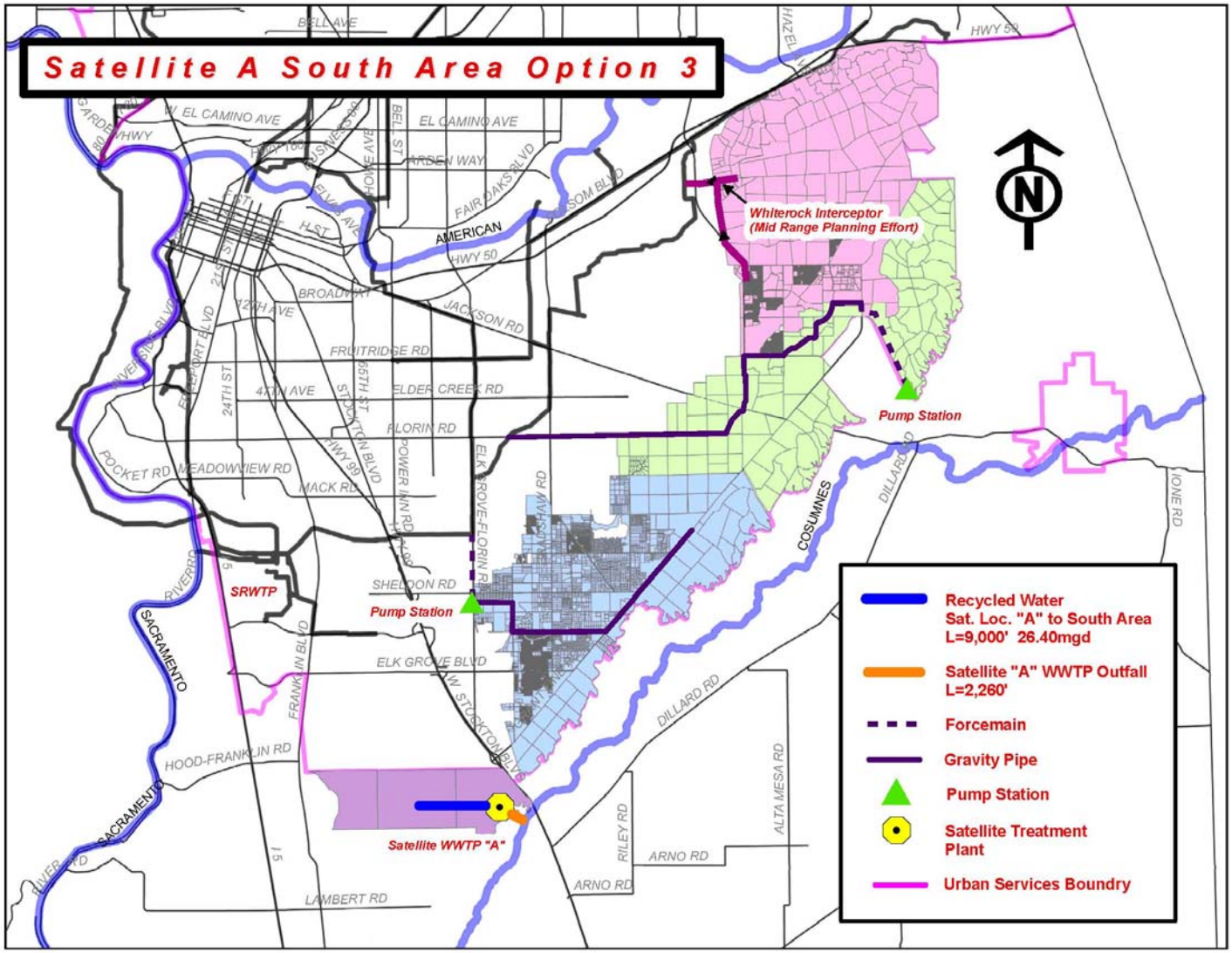
6.3 Satellite A South Area Option 3

(See Figure 15.18). The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. Separately, flows in the Sheldon area are piped to the Bradshaw Interceptor via the Sheldon Interceptor while the flows from the Elk Grove SOI flow directly into the Satellite A treatment plant. The Florin Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area to Bradshaw Interceptor via the Florin Road corridor. The Sheldon Interceptor begins as a gravity line, taking flows west to Elk Grove-Florin Road where a pump station and force main connect to Bradshaw Interceptor to the north.

A recycled water transmission pipeline from the Satellite A treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With about 26 miles of interceptor pipeline, two pump stations and a 26-MGD Satellite A treatment facility, this alternative has the lowest total cost among all the satellite treatment alternatives. It does, however, send the least amount of wastewater to a satellite treatment facility.

Figure 15.18 Satellite A South Area Option 3



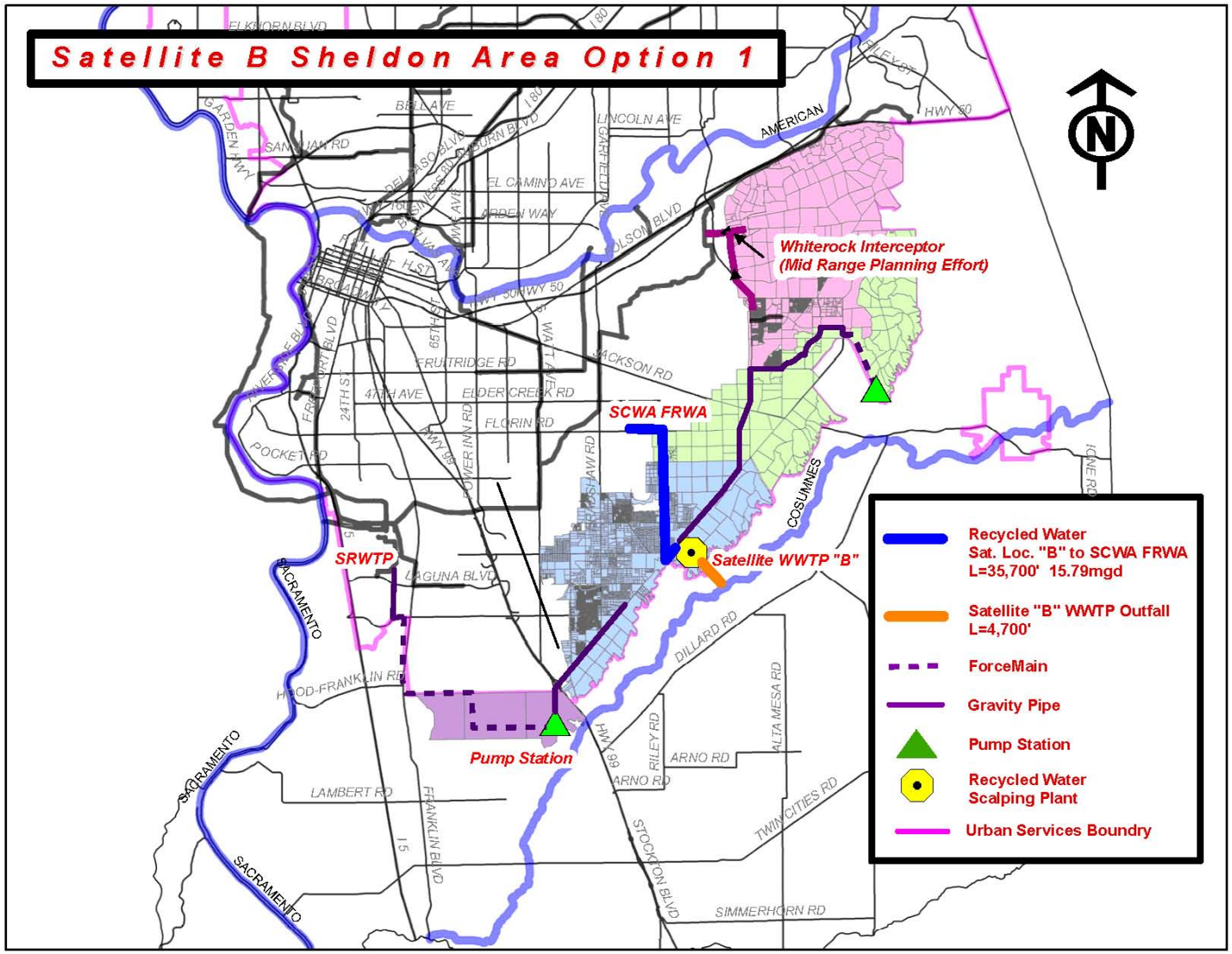
6.4 Satellite B Sheldon Area Option 1

(See Figure 15.19). The sewer conveyance option in this satellite alternative sends all the flows from the East County area and most of the Sheldon area to the Satellite B treatment plant via the Satellite B Interceptor. The remaining flows south of this would be conveyed to the SRWTP via the Laguna/South Interceptor. The Satellite B Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area and most of the Sheldon area, south to the Satellite B Plant. The Laguna/South Interceptor gravity flows to a pump station in Elk Grove which conveys the flows through a force main north-west to the SRWTP.

A recycled water transmission pipeline from the Satellite B treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With about 34 miles of interceptor pipeline, two pump stations and an 87-MGD Satellite B treatment facility, this alternative ranks fifth in total cost among all the satellite treatment alternatives. The amount of flow sent to satellite treatment under this alternative also ranks fifth among all the satellite treatment alternatives.

Figure 15.19 Satellite Satellite B Sheldon Area Option 1



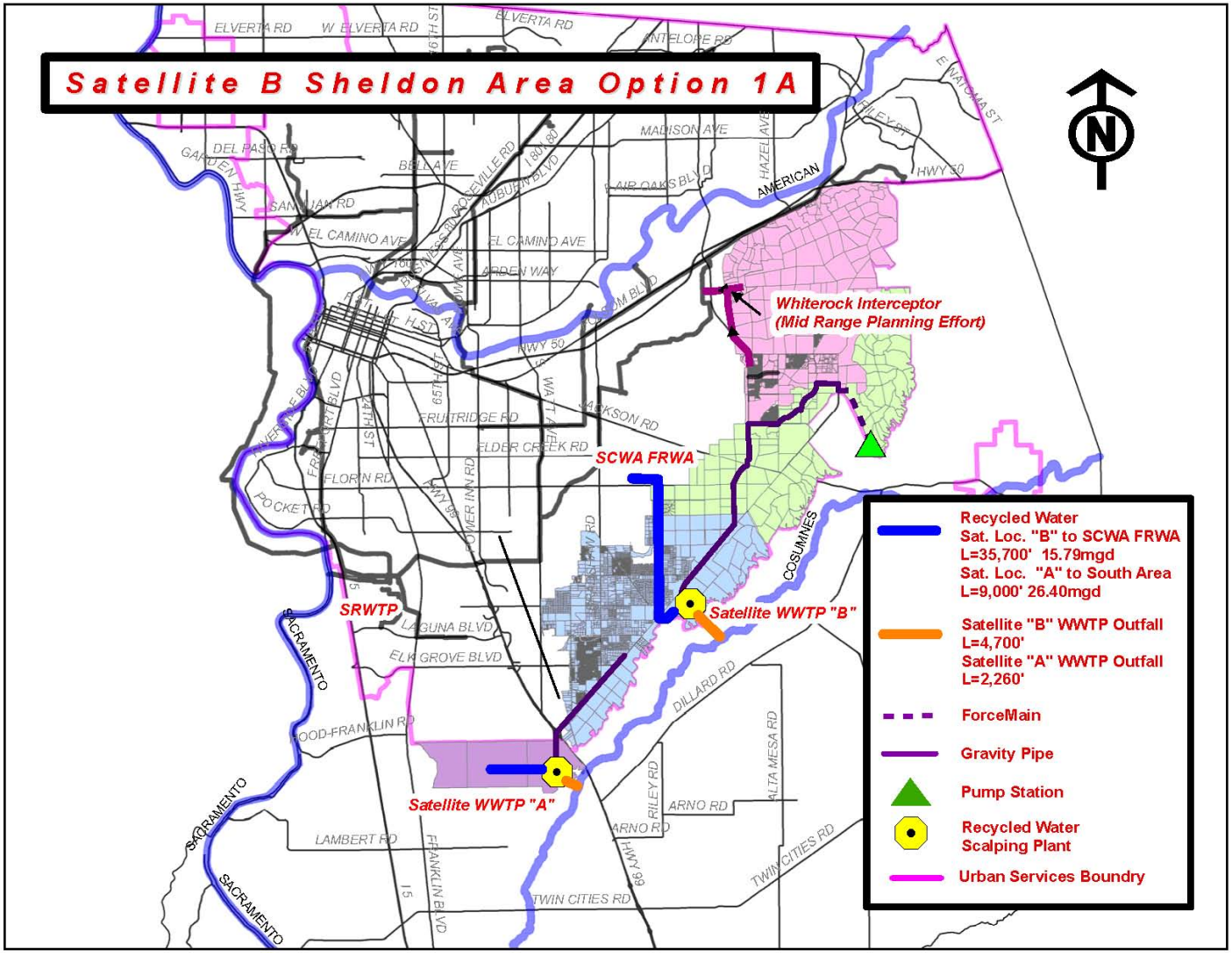
6.5 Satellite B Sheldon Area Option 1A

(See Figure 15.20). The sewer conveyance option in this satellite alternative sends all the flows from the East County area and most of the Sheldon area to the Satellite B treatment plant via the Satellite B Interceptor. The remaining flows south of this would be conveyed by gravity to the Satellite A treatment plant using both direct pipelines from the surrounding Elk Grove SOI area and from the Satellite A Interceptor. The Satellite B Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area and most of the Sheldon area, south to the Satellite B plant.

Two recycled water transmission pipeline: one from the Satellite B treatment plant to a central location in the Sheldon area, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

This option has only 23 miles of interceptor pipeline with one pump station but two satellite treatment facilities, an 87-MGD Satellite B and a 42-MGD Satellite A treatment facility. This alternative has the highest total cost among all the satellite treatment alternatives since it sends all its flow to satellite plants with none going to Bradshaw Interceptor or directly to SRWTP.

Figure 15.20 Satellite Satellite B Sheldon Area Option 1A



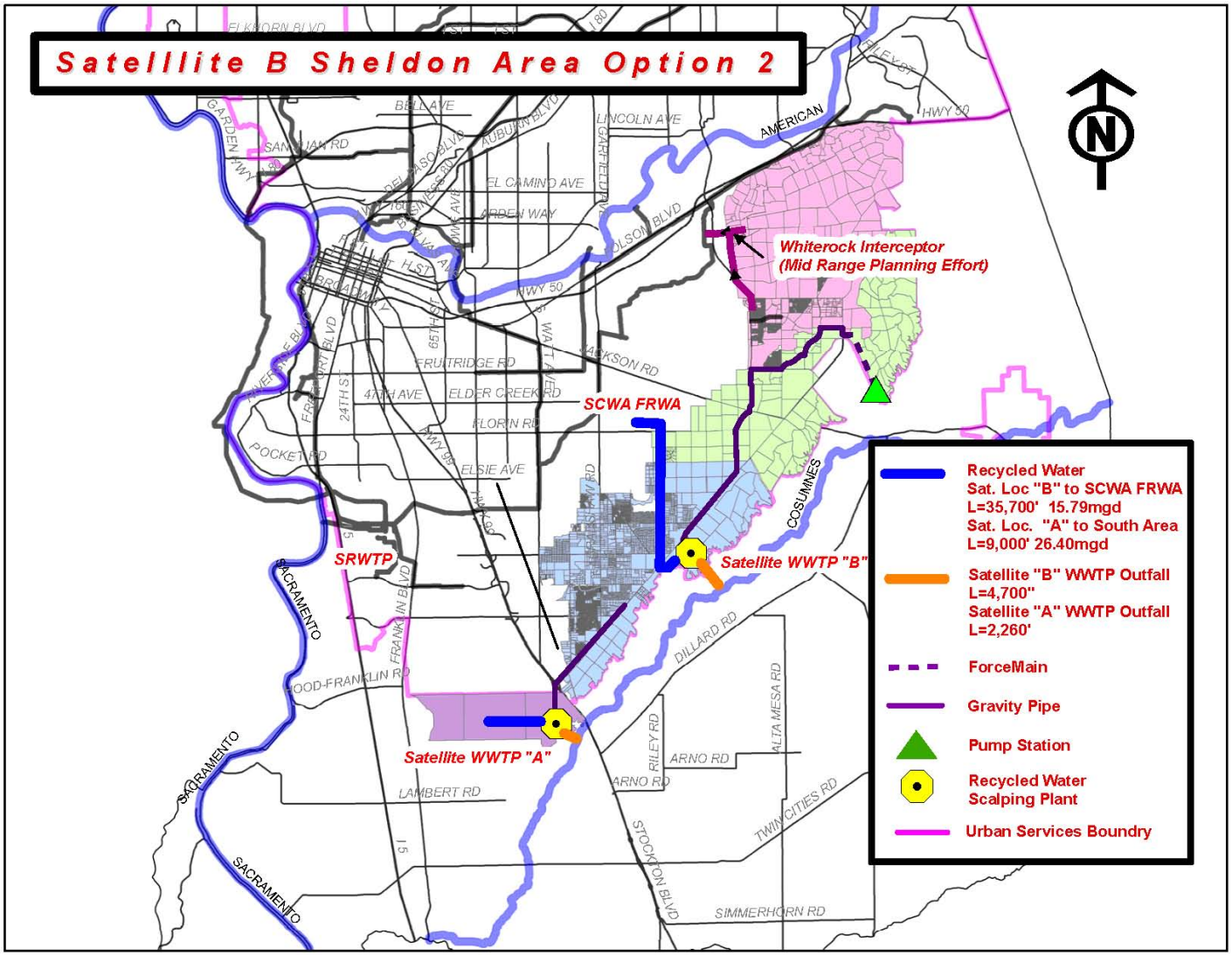
6.6 Satellite B Sheldon Area Option 2

(See Figure 15.21). The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. Separately, most of the Sheldon area, south of East County, is conveyed to the Satellite B treatment plant by gravity via the Satellite B Interceptor. The remaining flows south of this would be conveyed using the Laguna/South Interceptor to the SRWTP. The Florin Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area to Bradshaw Interceptor via the Florin Road corridor. The Laguna/South Interceptor gravity flows to a pump station in Elk Grove which conveys the flows through a force main north-west to the SRWTP.

A recycled water transmission pipeline from the Satellite B treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With 37 miles of interceptor pipe and two pump stations, this is the most expensive conveyance system among the four Satellite B alternatives. However, it sends the least amount of flow (35-MGD) to a satellite treatment facility, which makes the total cost the second least expensive among all satellite treatment alternatives.

Figure 15.21 Satellite Satellite B Sheldon Area Option 2



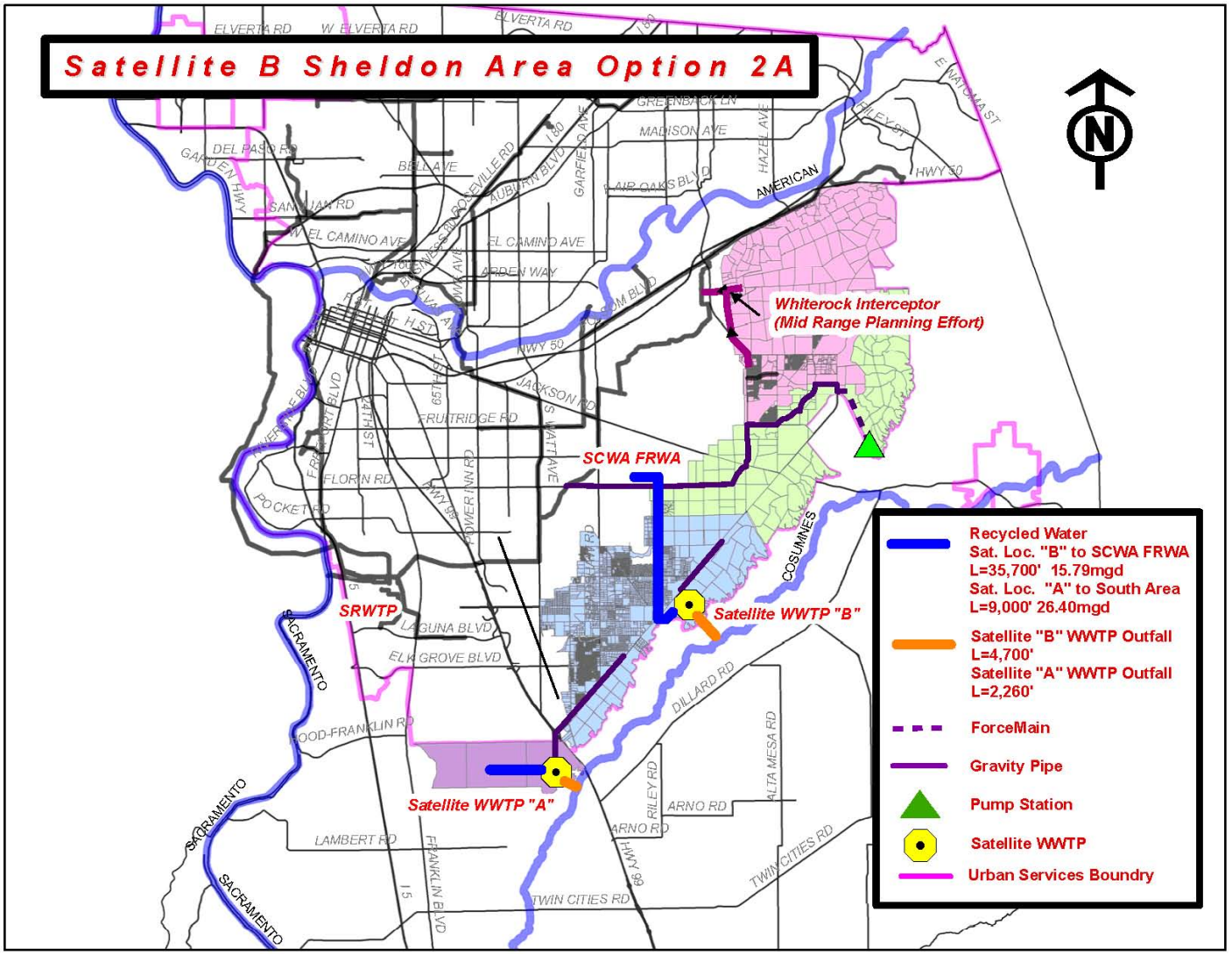
6.7 Satellite B Sheldon Area Option 2A

(See Figure 15.22). The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. Separately, most of the Sheldon area, south of East County, is conveyed to the Satellite B treatment plant by gravity via the Satellite B Interceptor. The remaining flows south of this would be conveyed using the Satellite A Interceptor to the Satellite A treatment plant. The Florin Interceptor begins with a 20 MGD pump station and force main to take Cordova Hills flows over to the Suncreek/Waegell areas where the gravity portion takes these flows, and the remaining flows from the East County area to Bradshaw Interceptor via the Florin Road corridor.

Two recycled water transmission pipeline: one from the Satellite B treatment plant to a central location in the Sheldon area, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With 26 miles of interceptor pipe and just one pump station, this is the second least expensive conveyance system among the four Satellite B alternatives. However, flow is being sent to two satellite plants (35 MGD to Satellite B and 39 MGD to Satellite A) which makes the total cost for this alternative sixth ranked among all the satellite treatment alternatives. The amount of flow sent to satellite treatment under this alternative also ranks sixth among all the satellite treatment alternatives.

Figure 15.22 Satellite Satellite B Sheldon Area Option 2A



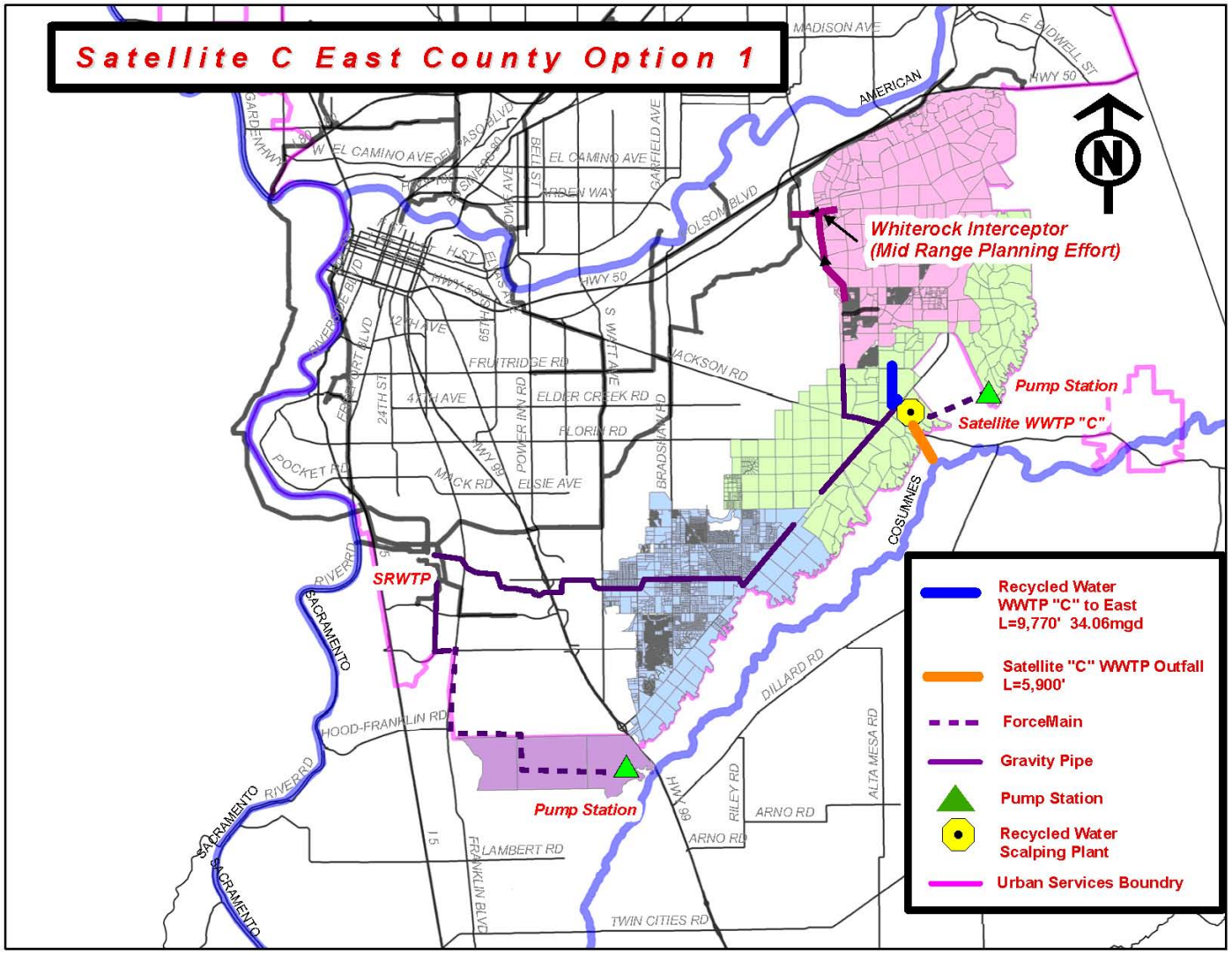
6.8 Satellite C East County Option 1

(See Figure 15.23). The sewer conveyance option of this satellite alternative sends all the flows from the East County area to the Satellite C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Satellite C Interceptor. Separately, wastewater from the Sheldon area would be gravity fed west to the SRWTP via the Sheldon Interceptor. Finally the South Area flows (Elk Grove SOI) will be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

A recycled water transmission pipeline from the Satellite C treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

This alternative's conveyance system has over 32 miles of pipeline and two pumps stations. These make it the most expensive conveyance system of the Satellite C options and it sent over 70 MGD of flow to the Satellite C treatment plant. Total cost for this alternative ranks seventh among all the satellite treatment alternatives. The amount of flow sends to satellite treatment under this alternative also ranks eighth among all the satellite treatment alternatives.

Figure 15.23 Satellite C East County Option 1



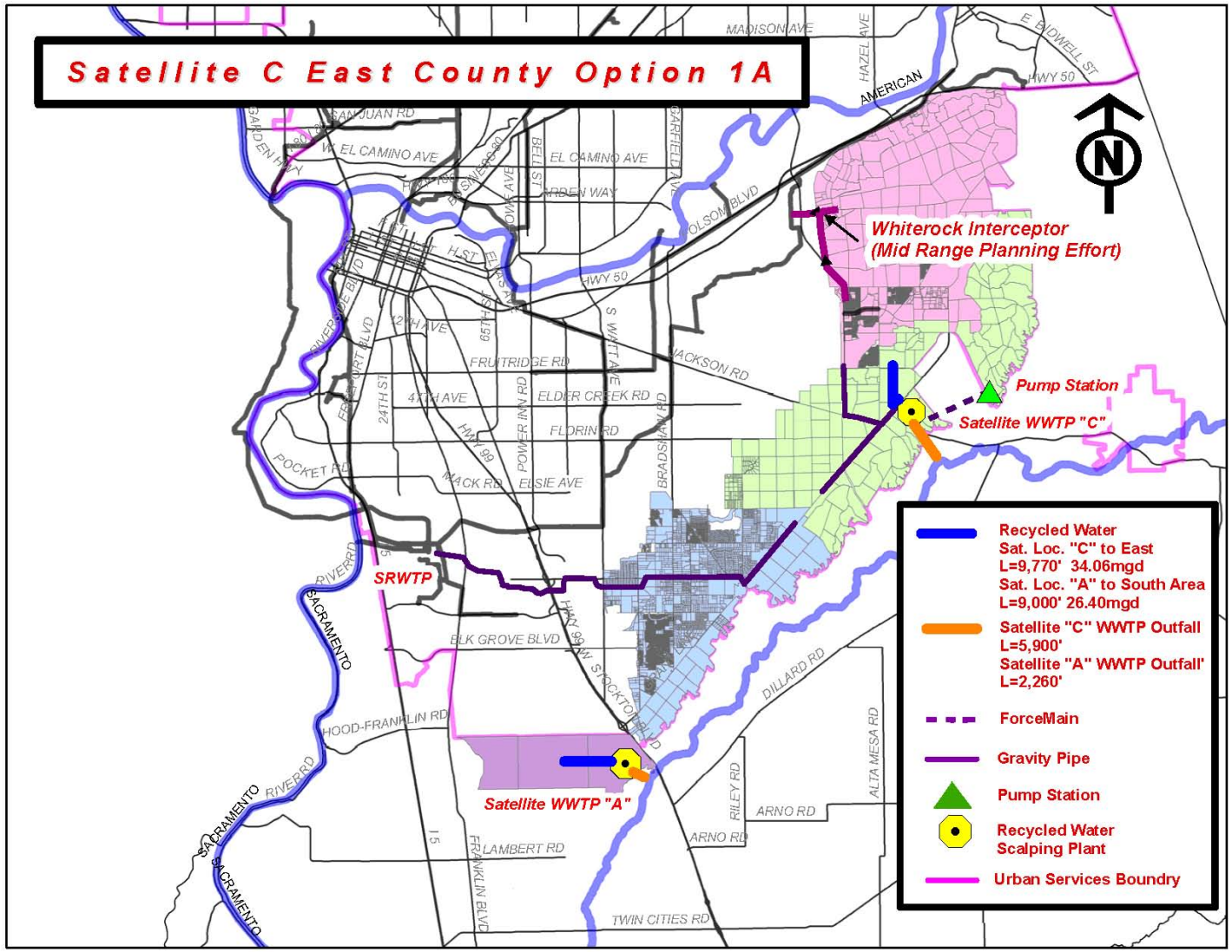
6.9 Satellite C East County Option 1A

(See Figure 15.24). The sewer conveyance option of this satellite alternative is similar to Option 1 except without the South Interceptor. It sends all the flows from the East County area to the Satellite C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Satellite C Interceptor. Separately, wastewater from the Sheldon area would be gravity fed west to the SRWTP via the Sheldon Interceptor. Finally the South Area flows (Elk Grove SOI) will be conveying directly to the Satellite A treatment plant.

Two recycled water transmission pipeline: one from the Satellite C treatment plant to a central location in the East county, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

This alternative's conveyance system has only 22 miles of interceptor pipe and one pump station. This makes the conveyance the second least expensive amongst the four Satellite C alternatives. However, flow is being sent to two satellite plants (70 MGD to Satellite C and 26 MGD to Satellite A) which makes the total cost for this alternative third ranked among all the satellite treatment alternatives. The amount of flow sent to satellite treatment under this alternative also ranks third among all the satellite treatment alternatives.

Figure 15.24 Satellite C East County Option 1A



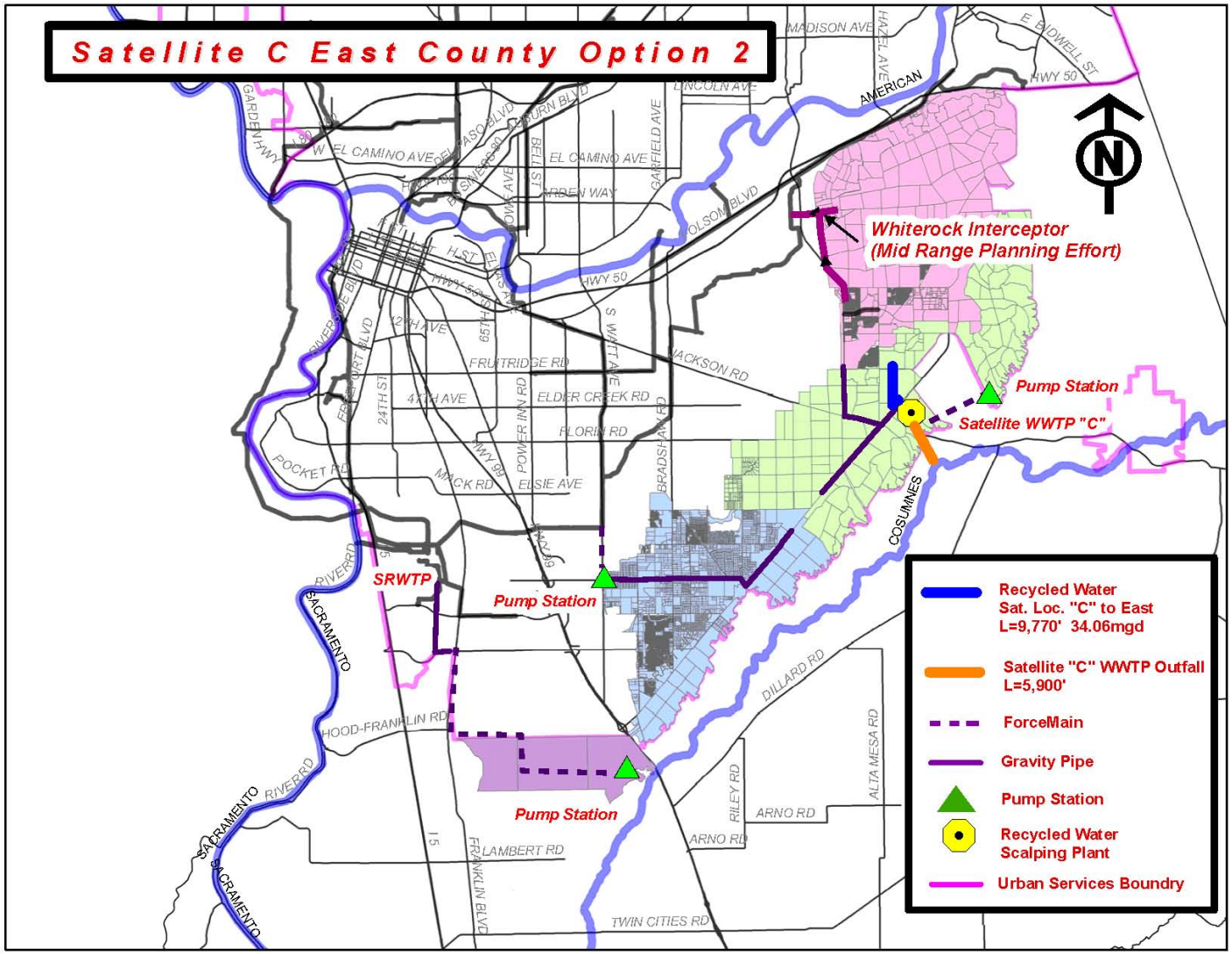
6.10 Satellite C East County Option 2

(See Figure 15.25). Similar to Option 1, the sewer conveyance option of this satellite alternative sends all the flows from the East County area to the Satellite C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Satellite C Interceptor. Separately, wastewater from the Sheldon area would, at first, be gravity fed west, via the Sheldon Interceptor. But then, unlike Option 1, a 31 MGD pump station and force main will connect flows to the Bradshaw Interceptor on Elk Grove-Florin Road and takes them on to the SRWTP. Finally, the South Area flows (Elk Grove SOI) will be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

A recycled water transmission pipeline from the Satellite C treatment plant to the same central location as the centralized treatment alternatives where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

With 29 miles of interceptor pipeline, three pump stations a 70-MGD Satellite C treatment facility, this alterative has the fourth lowest total cost among all the satellite treatment alternatives. Under this alternative, 70 MGD of wastewater will be conveyed to a satellite treatment facility.

Figure 15.25 Satellite C East County Option 2



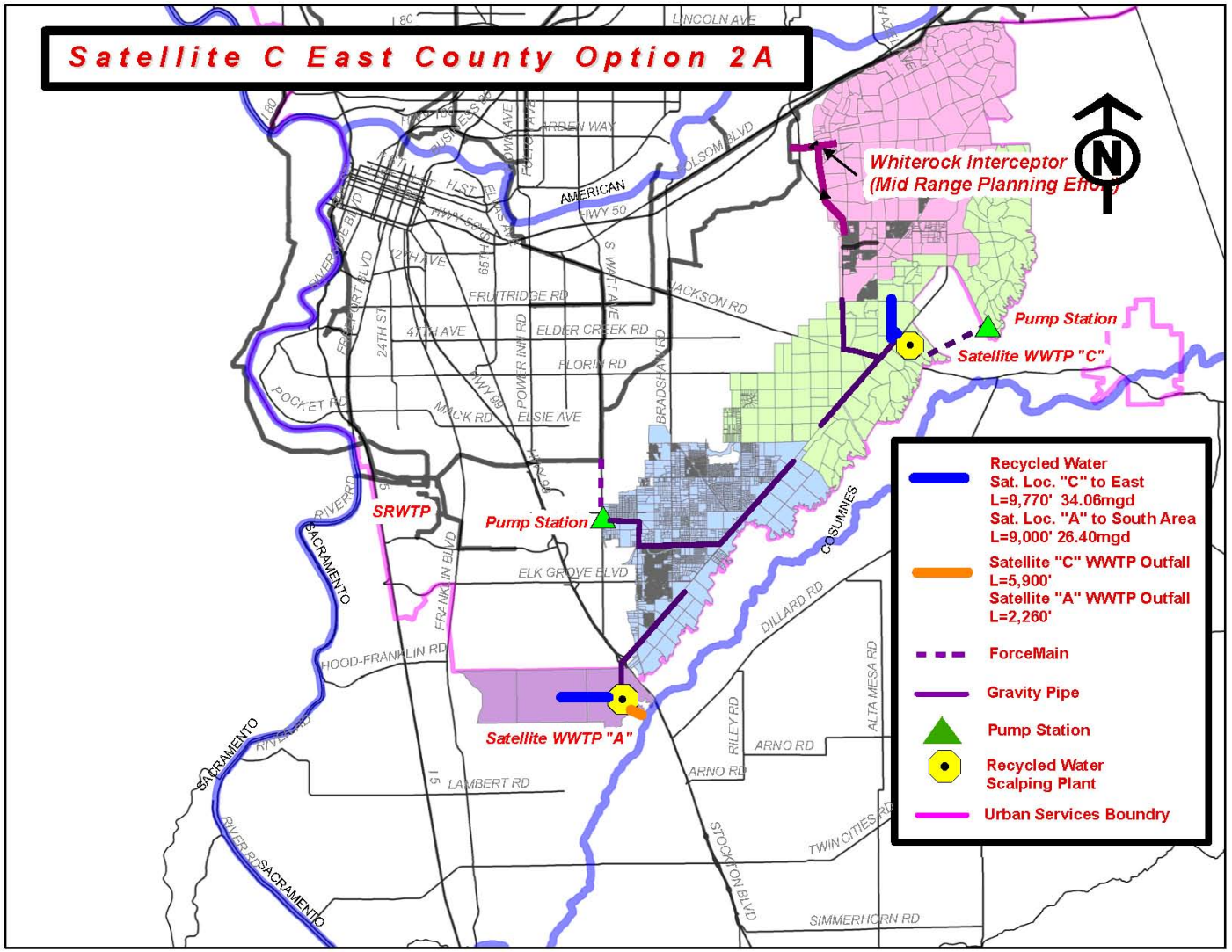
6.11 Satellite C East County Option 2A

(See Figure 15.26). The sewer conveyance option of this satellite alternative is similar to Option 2 except without the South Interceptor. It sends all the flows from the East County area to the Satellite C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Satellite C Interceptor. Separately, wastewater from the Sheldon area would, at first, be gravity fed west, via the Sheldon Interceptor. Then a 31 MGD pump station and force main will connect flows to the Bradshaw Interceptor on Elk Grove-Florin Road and takes them on to the SRWTP. Finally, the South Area flows (Elk Grove SOI) will be conveyed by gravity directly to the Satellite A plant via the Satellite A Interceptor.

Two recycled water transmission pipeline: one from the Satellite C treatment plant to a central location in the East county, another one from the Satellite A treatment plant to a central location in the South area where a local water provider will tie in to their recycled water distribution piping system in the future and a pumping facility will also be constructed under this alternative.

This alternative's conveyance system has only 18 miles of pipeline and two pump stations. This makes it the least expensive conveyance system of the Satellite C options (or any of the Satellite locations). However, flow is being sent to two satellite plants (70 MGD to Satellite C and 26 MGD to Satellite A) which makes the total cost for this alternative fourth ranked among all the satellite treatment alternatives. The amount of flow sent to satellite treatment under this alternative ranks third among all the satellite treatment alternatives.

Figure 15.26 Satellite C East County Option 2A



7.0 ANALYSIS OF ALTERNATIVES

Major cost assumptions set out in Technical Memorandum No. 9 (Unit Costs for Centralized, Scalping, and Satellite Wastewater Treatment Plants), and procedures stated in Technical Memorandum No. 10 (Life Cycle Costs for Centralized, Scalping, and Satellite Facilities) are used for the cost analysis. Centralized treatment alternatives have much lower total project cost than both scalping and satellite treatment alternatives mainly due to lower operation and maintenance cost. Furthermore, the centralized treatment option provides the flexibility to change the recycled water delivery capacity by modifying the size of the transmission piping and the pumping facility.

Using the criteria set out in Technical Memorandum No. 8 (Risks Analysis), risk assessment was done on all centralized and scalping treatment alternatives. The centralized treatment alternatives have a lower risk cost than the scalping and satellite treatment alternatives. Risk costs of individual alternatives are shown in Table 15.4 and 15.5. Risk analysis was not performed on all "A" conveyance options for the scalping treatment alternatives. These alternatives were eliminated due to a higher capital cost when compared to other scalping treatment alternatives.

7.1 Cost Analysis Summary

7.1.1 Centralized Treatment Alternatives

Table 15.2 Centralized Treatment Alternatives Cost Analysis Summary

Alternative	Total Cost (In Million Dollars)[1]	Rank	Potential Recycled Water Capacity (In MGD)[22]	Rank
South Area Recycled Water – Conveyance Option 3	874	1	12.2	3
Sheldon Area Recycled Water – Conveyance Option 3	958	2	15.8	2
East County Recycled Water – Conveyance Option 3	1619	3	34.1	1

Note 1: Cost ranking from lowest to highest
Note 2: Flow ranking from highest to lowest

7.1.2 Scalping Treatment Alternatives

Table 15.3 Scalping Treatment Alternatives Cost Analysis Summary

Alternative	Total Cost (In Million Dollars)[1]	Rank	Flow to Decentralized Treatment Facility (In MGD)[2]	Rank	Potential Recycled Water Capacity (In MGD)[2]	Rank
Scalping B Sheldon Area Option 1	2,212	4	87	4	42.5	4
Scalping B Sheldon Area Option 1A	3,784	8	129	1	62.1	1
Scalping B Sheldon Area Option 2	1,135	1	34.9	8	15.8	8
Scalping B Sheldon Area Option 2A	2,328	5	73.9	5	33.7	7
Scalping C East County Option 1	1,859	3	70.2	6*	34.1	5*
Scalping C East County Option 1A	2,909	7	96.6	2*	46.3	2*
Scalping C East County Option 2	1,817	2	70.2	6*	34.1	5*
Scalping C East County Option 2A	2,852	6	96.6	2*	46.3	2*

Note 1: Cost ranking from lowest to highest
Note 2: Flow ranking from highest to lowest
* Tie

7.1.3 Satellite Treatment Alternatives

Table 15.4 Satellite Treatment Alternatives Cost Analysis Summary

Alternative	Total Cost (In Million Dollars)[1]	Rank	Flow to Decentralized Treatment Facility (In MGD)[2]	Rank	Potential Recycled Water Capacity (In MGD)[2]	Rank
Satellite A South Area Option 1	3,823	10	121.9	2	60.9	2
Satellite A South Area Option 2	2,369	3	71.1	7	34.0	6
Satellite A South Area Option 3	1,124	1	26.4	11	12.2	11
Satellite B Sheldon Area Option 1	2,934	7	87	5	42.5	5
Satellite B Sheldon Area Option 1A	4,040	11	129.3	1	62.1	1
Satellite B Sheldon Area Option 2	1,417	2	34.9	10	15.8	10
Satellite B Sheldon Area Option 2A	2,460	6	73.9	6	33.7	9
Satellite C East County Option 1	2,444	5	70.2	8*	34.1	7*
Satellite C East County Option 1A	3,112	9	96.6	3*	46.3	3*
Satellite C East County Option 2	2,399	4	70.2	8*	34.1	7*
Satellite C East County Option 2A	3,055	8	96.6	3*	46.3	3*

Note 1: Cost ranking from lowest to highest
Note 2: Flow ranking from highest to lowest
* Tie

7.2 Risk Analysis Summary

7.2.1 Centralized Treatment Alternatives

Table 15.5 Centralized Treatment Alternatives Risk Analysis Summary

Alternative	Asset Service and Reliability	Environment	Financial	Legal	Public Health	Public Trust	Regulatory	**Total Annual Risk Cost**	**40 yr NPV** (5% Inflation, 5% Discount)
South Area Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000
Sheldon Area Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000
East County Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000

7.2.2 Scalping Treatment Alternatives

Table 15.6 Scalping Treatment Alternatives Risk Analysis Summary

Alternative	Asset Service and Reliability	Environment	Financial	Legal	Public Health	Public Trust	Regulatory	**Total Annual Risk Cost**	**40 yr NPV** (5% Inflation, 5% Discount)
Scalping B Sheldon Area Option 1	Low $5,000	Low $2,000	Low $5000	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping B Sheldon Area Option 2	Low $5,000	Low $2,000	Low $5000	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping C East County Option 1	Low $5,000	Low $2,000	Low $5000	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping C East County Option 2	Low $5,000	Low $2,000	Low $5000	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000

7.2.3 Satellite Treatment Alternatives

Table 15.7 Satellite Treatment Alternatives Risk Analysis Summary

Alternative	Asset Service and Reliability	Environment	Financial	Legal	Public Health	Public Trust	Regulatory	Total Annual Risk Cost	40 yr NPV (5% Inflation, 5% Discount)
Satellite A South Area Option 1	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite A South Area Option 2	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite A South Area Option 3	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite B Sheldon Area Option 1	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite B Sheldon Area Option 1A	Medium $50,000	High $500,000	Critical $1,000K	Critical $1,000K	Medium $50,000	Medium $50,000	Critical $1,000K	$3,620,000	$137,905,000
Satellite B Sheldon Area Option 2	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite B Sheldon Area Option 2A	Medium $50,000	High $500,000	Critical $1,000K	Critical $1,000K	Medium $50,000	Medium $50,000	Critical $1,000K	$3,620,000	$137,905,000
Satellite C East County Option 1	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite C East County Option 1A	Medium $50,000	High $500,000	Critical $1,000K	Critical $1,000K	Medium $50,000	Medium $50,000	Critical $1,000K	$3,620,000	$137,905,000
Satellite C East County Option 2	Low $5,000	Medium $200,000	Medium $100,000	Critical $1,000K	Medium $50,000	Medium $50,000	High $500,000	$1,875,000	$71,429,000
Satellite C East County Option 2A	Medium $50,000	High $500,000	Critical $1,000K	Critical $1,000K	Medium $50,000	Medium $50,000	Critical $1,000K	$3,620,000	$137,905,000

When comparing risk costs to the overall capital costs for all the alternatives, they are not financially significant. But it should be noted the centralized treatment alternatives have lower risk costs than the scalping and satellite treatment alternatives due to lower risk of legal and public health concerns.

7.3 Top Alternatives

The top alternative from each of the treatment options is selected based on the lowest total cost and the lowest risk.

8.0 RECOMMENDATION

- If the SRCSD chooses to handle sanitary sewer conveyance through satellite facilities, staff recommends that the Satellite A Option 3 as the most cost efficient

and flexible solution to serve the South County. Staff does not recommend the use of satellite facilities for the East County and Sheldon areas.

- The SRWTP Centralized treatment alternatives are the best options for providing recycled water to the three general areas (South, Sheldon and East County) evaluated in this study. Centralized treatment is the most cost effective option and it provides maximum flexibility.