Submitted to:

Washington City
Where Dixie Begins

I-15 MILEPOST 11

CONCEPT STUDY

August 2014

Submitted by:

HORROCKS
ENGINEERS

INTRODUCTION

Goals and Objectives

The purpose of the concept study is to develop a starting point that analyzes an interchange at Milepost 11 on I-15 in Washington City. It uses sound transportation planning and engineering principles to identify existing and future traffic and identify a short list of possible alternatives for an interchange at Milepost 11 to be developed and further evaluated. It will provide the City with progressive steps toward constructing this interchange. This Concept Study for the proposed interchange is the forerunner to an environmental document and an Interchange Access Change Report.

Study Team

The study team was made up of representatives from the City of Washington, the Dixie Metropolitan Planning Organization (Dixie MPO), UDOT, and Horrocks Engineers. The team was tasked to establish the initial goals and objectives of the project and direct the study effort. The team was made up of the following individuals:

Dana Meier	UDOT, Project Manager
Mike Shaw	City of Washington
Bronson Bundy	City of Washington
David Demas	Dixie MPO
Myron Lee	Dixie MPO
Curt Hutchings	Dixie MPO
Russell Youd	Principal, Horrocks Engineers
Lee Cabell	Principal, Horrocks Engineers
Aron Baker	Project Manager, Horrocks Engineers
Mike Heaps	Traffic Engineer, Horrocks Engineers

Study Location

The I-15 Milepost 11 Concept Study considers the benefits and impacts of an important connection to I-15 in the rapidly growing urbanized area of Washington City. Because of the on-going traffic pressure at Green Springs Drive and Telegraph Road as well as the Milepost 10 interchange, this new interchange location shows valuable benefits to the Milepost 10 area.

The study area addresses two specific locations. The first is where Main Street passes under I-15 and the second is where 300 East would intersect with I-15 if it were extended to the north, as shown in Figure 1 below:

Figure 1: Study Location of Milepost 11 Interchange

BACKGROUND

Sunrise Engineering recently concluded the February 2014 study "Telegraph Road and Green Springs Drive Intersection Study" that evaluates the intersection at Telegraph Road and Green Springs Drive to determine what improvements can be programmed in future years to mitigate forecasted congestion (see Figure 2). The study area included the on- and off-ramps of I-15. Although the recommended alternative from the Sunrise study is to construct a partial thru-turn, one of the options that was considered is a new interchange at Milepost 11. As stated in the conclusion of the study, "It is … recommended that the City continue to take an active role in promoting regional connectivity that would provide alternative routes for drivers merely passing through the area." This Concept Study will look more closely at this interchange option to provide an alternate route to Washington City, thereby, relieving congestion at Telegraph Road and Green Springs Drive while maintaining the integrity of I-15.

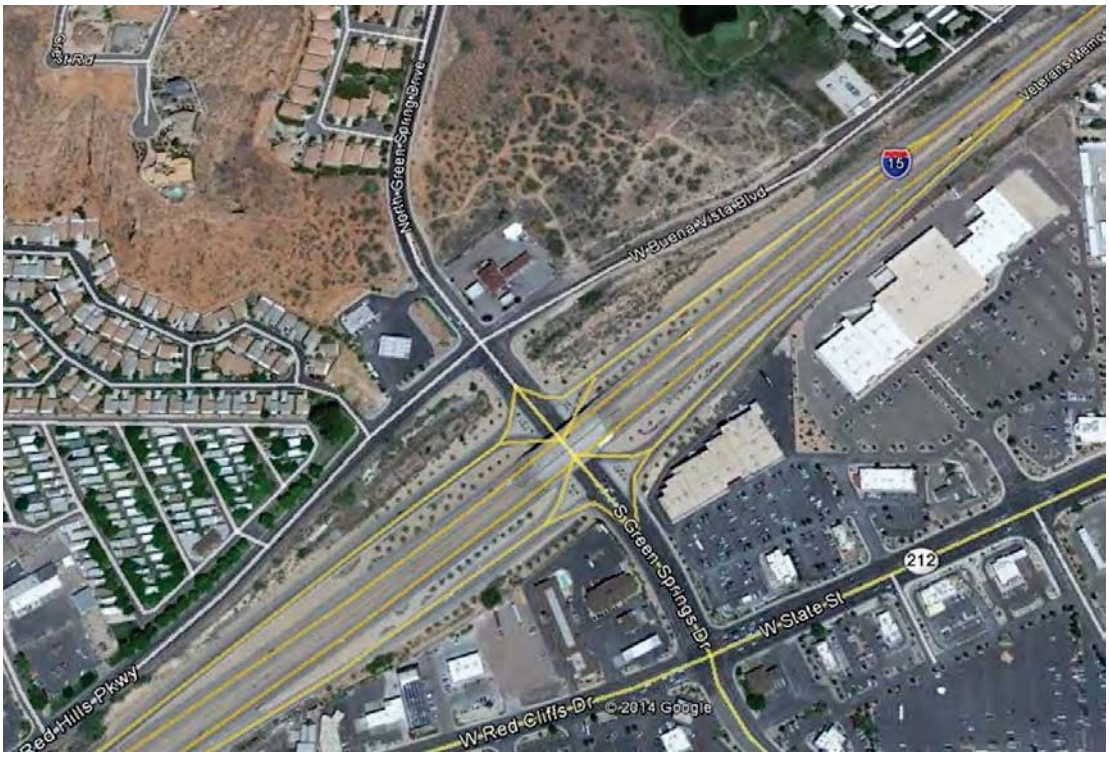


Figure 2: Interchange to existing Green Springs Drive and Telegraph Street intersection, I-15 Milepost 10.

Land Use

The zoning plan for the City of Washington along the study area exhibits a large amount of residential with primarily commercial along the Buena Vista Boulevard corridor on the north side of the freeway. There are various government buildings located south on 300 East such as the Washington City Community Center, Washington Elementary School, and the Washington Branch Library. The Washington City Cemetery is also located on this street. 300 East is a local collector street. It is a vital link to the Washington Fields area to the south as it has one of the only bridges in Washington that cross the Virgin River. Main Street to the south is almost exclusively residential except near Telegraph Street where there is a park, a church, and commercial uses. The U.S. Post Office is on the south side of Telegraph Street on Main Street. Main Street extends to the south toward the Virgin River, where it is planned to align to the east so it can join 300 East. Main Street to the north will connect to Washington Parkway, a major arterial, whereas 300 East does not have that option. The land use map is shown on Figure 3.

This interchange has been recognized by the City of Washington and is shown on an amendment to the City Road Master Plan (see Figure 4).

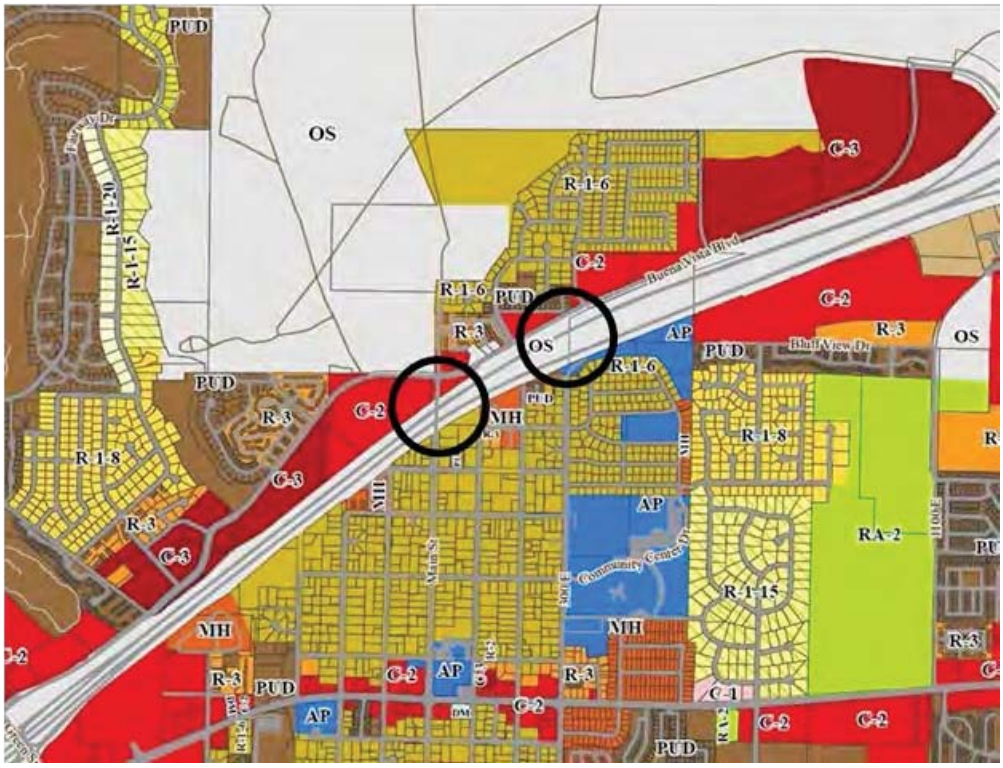


Figure 3: Land Use of Study Area for Milepost 11 Interchange

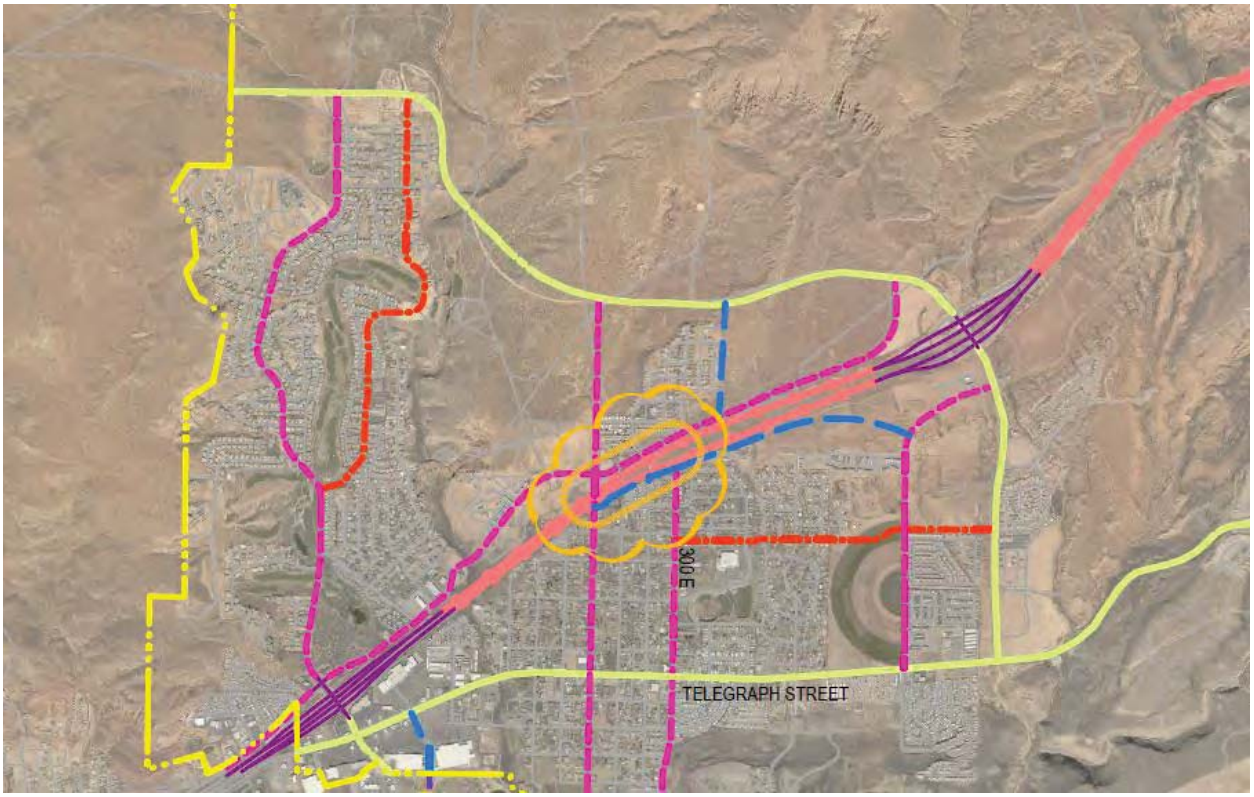


Figure 4: Washington City Road Master Plan

A concern that was brought forward by the team is the change in land use that could take place in future years due to the presence of an interchange. The land use, although mostly residential with some undeveloped sections of commercial, will likely become a more traffic-intense zone such as highway commercial, retail, or high density residential. A greater demand for driveways can create intersection and access spacing conflicts compared to single family zoning. Strict adherence to Washington's Access Management Policy will help to configure these changes to maintain free flow of traffic around the interchange.

Other Regional Plans

Besides the Washington City General Plan, other projects, studies, and planning efforts that are or were being performed in the area that were considered during the study include:

- St. George Boulevard and I-15
- Green Springs Drive and Telegraph Street
- Mall Drive Crossing at I-15
- I-15 Milepost 0 to 16 EA
- Dixie MPO Long Range Plan

Projected Growth

Washington County has experienced high growth for the past two decades. There was a slowdown of growth from 2008 to 2012, but the trend of steady growth is returning and expected to continue. Table 1 outlines past and anticipated population growth trends for the region reported by the Utah Governor's Office of Planning and Budget.

Table 1: Population Projections

City	1990 Census Population	2000 Census Population	2010 Census Population	2040 Population Projection	2010-2040 Population Growth
St. George	28,572	49,663	72,876	151,187	107%
Hurricane	3,915	8,250	13,313	64,079	381%
Washington City	4,198	8,186	18,532	70,072	278%
Ivins	1,630	4,450	6,709	17,845	166%
LaVerkin	1,771	3,392	4,035	8,492	110%
Hildale	1,325	1,895	2,734	8,074	195%
Enterprise	936	1,285	1,664	5,356	222%
Santa Clara	2,322	4,630	6,016	14,472	141%
Toquerville	488	910	1,362	6,149	351%
Washington County Total	48,274	89,718	136,887	366,132	167%

Source: Utah Governor's Office of Planning & Budget

As shown in Table 1, the population of Washington City is expected to nearly quadruple from the year 2010 to 2040, rising from 18,532 to 70,072.

Existing Traffic Delays

The overall concern that has initiated this study is the impact that future growth will have on the intersection of Green Springs Drive and Telegraph Road. Overwhelming congestion will negatively impact the ramps at the SPUI at Milepost 10 and create unacceptable delay by 2030. The existing delays were measured and reported in Sunrise Engineering's "Telegraph Road and Green Springs Drive Intersection Study" completed in February of this year. Assuming the I-15 Mall Drive crossing was completed, that a collector road was connected into St. George between Wal-Mart and Home Depot was completed, and the Mall Drive Bridge over the Virgin River is open, the delays to the intersection is shown in Table 2:

Table 2: Existing Level Of Service at Green Springs Drive & Telegraph Road

Year	LOS*	Delay (sec)
2012	C	32.0
2013	E	43.0
2014	F	56.1

*LOS – Level Of Service

Existing I-15 Corridor Description

The existing corridor from Milepost 8 to Milepost 13 is a 4-lane freeway section with 2 general use lanes in each direction. It is posted at 65 miles per hour from Milepost 8 to Milepost 10. The posted speed increases north of Milepost 10 to 75 mph, which is the posted speed that would impact the proposed interchange.

There is a plan by the year 2030 to add another general use lane in each direction on mainline I-15 through the St. George area that would include between Milepost 8 and Milepost 13 and beyond.

ANALYSIS

Study Methodology

The concept study performed traffic operational analyses using the Synchro / SimTraffic software package to evaluate possible alternatives intended to meet the current and future travel demand for a future interchange at I-15 Milepost 11. The study used a methodology that was based on the following elements or tasks:

- Integrate City-provided traffic volume and turning movement data into Synchro 8
- Integrate traffic volumes into Synchro 8 from the Dixie MPO travel demand model for analysis years (2020 and 2040)
- Prepare concept interchange designs for both locations and prepare planning level cost estimates
- Develop traffic simulation and operational analysis models
- Perform interchange operational analysis for various alternatives
- Prepare a report summarizing the results of the analysis

Travel Demand Modeling

The Dixie MPO Travel Demand Model (TDM) was used for the study area to facilitate the forecasting of future traffic volumes. The model is a mathematical representation of travel behavior and utilizes land use data, observed travel behavior, and roadway network information to forecast future traffic volumes along selected roadways.

The modeling performed in this study is for four scenarios; for both 2020 and 2040 for each of the two locations.

FUTURE TRAFFIC VOLUMES

The base year used in the Dixie MPO regional travel demand model (TDM) for this study was 2012. Overall, the volumes of the network in the study area have been increasing at a rate of approximately 4% per year and it is anticipated that the growth will continue at that rate based on the regional growth projections. The future Average Daily Traffic (ADT) volumes were developed using the TDM. In developing the future projections, it was assumed that other regional and local improvements have been made consistent with the Dixie MPO Long Range Plan and the City of Washington Master Transportation Study, such as the Mall Drive Underpass and improvements at Milepost 10. Future projections were developed for the years 2020 and 2040.

The 2040 future volumes were compared with and without an interchange at both locations. The results are similar to that of the Green Springs & Telegraph Study, where an interchange at Main Street has slightly more impact on the Green Springs Drive Interchange, while an interchange at 300 East has slightly more impact on the Washington Parkway Interchange. These comparisons are tabulated in Table 3. The cross street will experience at least 20,000 vhp in 2040.

In 2040, I-15 mainline through this segment is expected to operate at LOS D, but is teetering on the border of LOS E for the northbound movement. If the hourly volume is increased by as little as 50 vph the LOS dips into the E range where additional lanes would then need to be considered.

Based on the traffic model, there are no discernable differences between the two interchanges in which interchange the driving public would use more from the Washington Fields area. However, 2040 traffic volumes on the interchange ramps are higher for the Main Street location than for the 300 East location (18,000 vpd vs. 14,000 vpd).

Table 3: Traffic Volumes and Traffic Shift Comparison

Traffic Shift w/ Main St and 300 E Interchanges

Telegraph/Green Springs Intersection: 2040 Volumes					
Intersection Leg	Base	w/ Main St Interchange		w/ 300 E Interchange	
		ADT	% Change	ADT	% Change
Telegraph Northleg	43,403	40,766	-6.1%	41,107	-5.3%
Green Springs Eastleg	18,039	17,503	-3.0%	17,557	-2.7%
Telegraph Southleg	31,359	30,685	-2.1%	30,525	-2.7%
Green Springs Westleg	30,307	28,635	-5.5%	29,452	-2.8%
Total	123,108	117,589	-4.5%	118,641	-3.6%

Buena Vista/Green Springs Intersection: 2040 Volumes					
Intersection Leg	Base	w/ Main St Interchange		w/ 300 E Interchange	
		ADT	% Change	ADT	% Change
Buena Vista Northleg	9,966	6,375	-36.0%	7,815	-21.6%
Green Springs Eastleg	18,948	17,282	-8.8%	17,984	-5.1%
Buena Vista Southleg	13,378	12,238	-8.5%	12,450	-6.9%
Green Springs Westleg	12,685	12,526	-1.3%	12,681	0.0%
Total	54,977	48,421	-11.9%	50,930	-7.4%

Green Springs Interchange: 2040 Ramp Volumes					
Ramp	Base	w/ Main St Interchange		w/ 300 E Interchange	
		ADT	% Change	ADT	% Change
Northbound Off	7,224	6,258	-13.4%	6,582	-8.9%
Northbound On	6,468	5,813	-10.1%	6,375	-1.4%
Southbound Off	6,658	6,940	4.2%	6,486	-2.6%
Southbound On	7,573	6,573	-13.2%	7,085	-6.4%
Total	27,923	25,584	-8.4%	26,528	-5.0%

Washington Parkway Interchange: 2040 Ramp Volumes					
Ramp	Base	w/ Main St Interchange		w/ 300 E Interchange	
		ADT	% Change	ADT	% Change
Northbound Off	3,197	2,333	-27.0%	2,127	-33.5%
Northbound On	10,090	7,849	-22.2%	7,816	-22.5%
Southbound Off	9,073	7,556	-16.7%	7,408	-18.4%
Southbound On	2,882	2,032	-29.5%	1,939	-32.7%
Total	25,242	19,770	-21.7%	19,290	-23.6%

The existing Milepost 10 interchange will not be able to accommodate the projected 2020 or 2040 planning level traffic volumes to have an acceptable level of service (LOS "D" or higher) without some type of improvement. An approach for implementing the Milepost 11 interchange improvements as well as other regional transportation improvements is critical to managing the projected local and regional travel demand.

ALTERNATIVES DEVELOPMENT

Alternative Development Discussion

The purpose of this study is not to pinpoint a recommended alternative of a proposed interchange. Alternatively, it begins the discussion to evaluate what possibilities exist and to reduce the number of possibilities to a manageable array so they can be individually studied in an environmental document. Both locations (Main Street and 300 East) were extensively analyzed to determine possible alternatives that would offer an optimum configuration.

The study team conceptually developed interchange scenarios that could conceivably work, based on the existing conditions with the primary goal to reduce traffic congestion at Milepost 10. There were 30 concepts that were suggested for review in the study (See Appendix to see all of the alternatives). Each of these concepts were discussed to uncover positives and negatives and to evaluate how they would fit in with existing topography, land uses, and street network. A ranking criteria was determined to evaluate each alternative with some equality. These 4 ranking criteria are listed here:

- Cleanly ties local road system and frontage roads together
- Minimizes impacts to houses and the local neighborhoods
- Accesses can be accommodated
- Maximizes traffic operations and safety

The project team applied these criteria to each concept and prepared a rank for each possible solution. The results of the ranking exercise is shown in the Appendix.

Engineering Criteria

As an additional step, each location was vetted by applying engineering standards to evaluate if the favored alternatives would physically work and could be built to FHWA standards. The parameters that were examined are:

- Vertical Clearance
- Signal Spacing
- Weaving Analysis
- Access Spacing

Vertical Clearance Analysis

It was important to address the situation of going over or under I-15 at both the Main Street and 300 East locations to establish if it could be done or not. There would be no sense in continuing discussions at one location or another if it proved to be impossible.

The bridges at Main Street going under I-15 are currently functionally obsolete due to the narrow width and low clearance (12'8"). The analysis shows that the currently alignment of Main Street can be lowered by about 6 feet to achieve a clearance of 16'6" going under I-15, considering utilities in Main Street can be dealt with. The profile is shown in Figure 5. The vertical clearance of 16'6" for the re-alignment of Main Street can also be obtained, as shown in Figure 6.

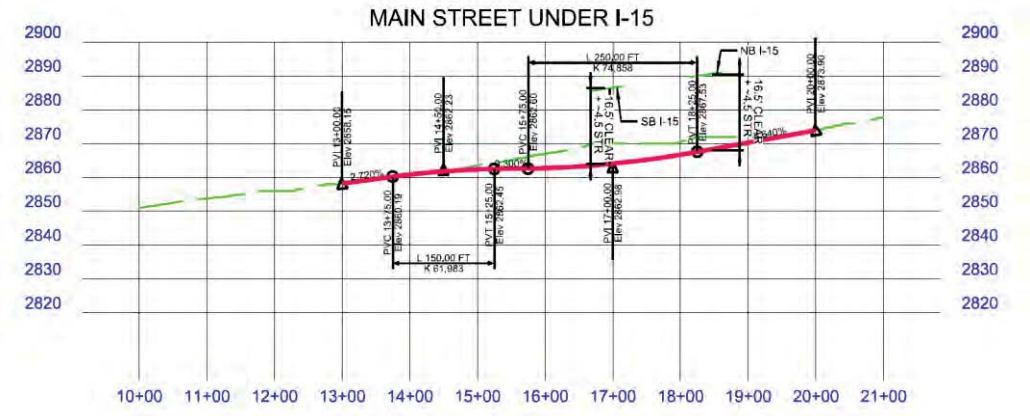


Figure 5: Vertical clearance of current alignment of Main Street going under I-15.

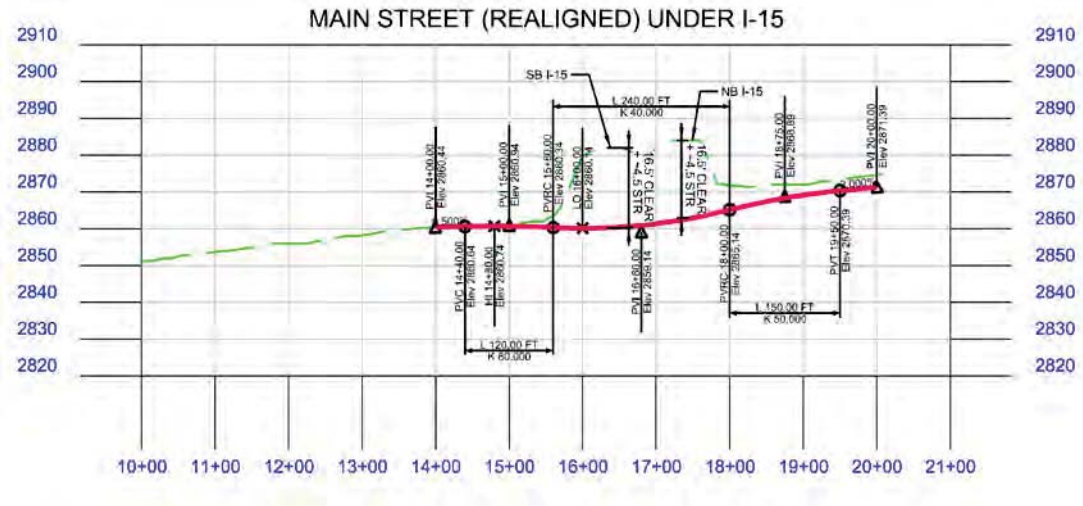


Figure 6: Vertical clearance of re-alignment of Main Street going under I-15.

The vertical clearance at 300 East creates a more difficult condition since I-15 is lower and closer to the surface elevation of 300 East. To try to go over I-15, with the approaches set at a maximum 7%, it would require 1,500 feet of length to meet with the existing road elevations on each side of the freeway (see Figure 7). Because of this large impact length, the more likely scenario would be to go under the interstate. This would require at least a 10-foot cut under the freeway with a new bridge, as shown in Figure 8. The vertical curves necessary to get under I-15 and their respective grades would impact the roadway for about 1,050 feet, where the Main Street crossing requires 700 feet. The grades do not approach the maximum of 7% in this scenario, but a more favorable 4.5% and 6% for the two approaches.

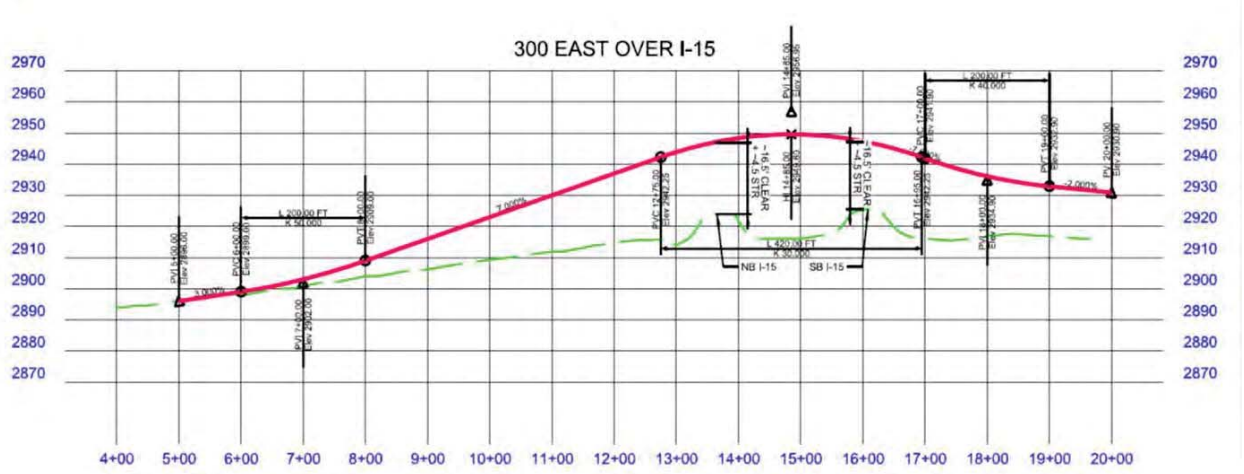


Figure 7: Vertical clearance of 300 East going over I-15.

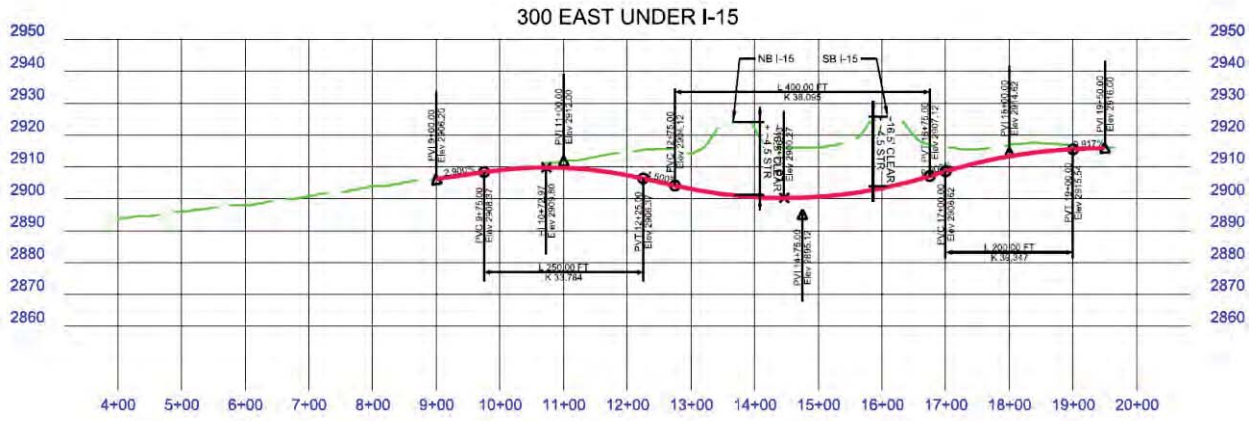


Figure 8: Vertical clearance of 300 East going under I-15.

In either case for Main Street or 300 East, it is apparent that it is possible to locate the interchange at either location from a vertical perspective, considering underground utilities can be managed.

Signal Spacing

The City of Washington Master Transportation Study and the City's Access Management Policy indicate that signal spacing should be a minimum of one-quarter mile, or 1,320 feet. This is to ensure the progressive movement of traffic through the signals now and in the future. The future traffic volumes at a Milepost 11 interchange would benefit from this important guidance.

Spacing that is closer than what is recommended will create interference patterns between the signals due to vehicles queuing into adjacent intersection areas, so traffic will be impacted by both traffic signals at once. Vehicle platooning will be a challenge to achieve due to this queuing. It will be imperative that these signals are closely monitored so their programmed synchronization patterns are seamless to reduce congestion.

When choosing an appropriate intersection configuration, care should be taken to maintain spacing at these intersections:

1) Buena Vista Boulevard
2) South Frontage Road
3) 300 North
4) 400 North

Weaving Analysis

The closest adjacent interchange to the proposed interchange location at Main Street (if Main Street were re-aligned to the south) would be Milepost 10 at 5,400 feet. Likewise, the proposed interchange location at 300 East would be 5,400 feet from the nearest interchange, which is Milepost 13. Both of the two merge movements, and two diverge movements, at each of the locations, are expected to operate at LOS D in 2040, using a worst case scenario for each movement. If the volumes are increased slightly, it would approach LOS E. If these higher volumes are used, the issues could be mitigated with longer acceleration and deceleration lanes.

In meeting with John Leonard, it was felt that either proposed interchange location could possibly be mitigated, if needed, by adding an auxiliary lane between the affected interchanges.

Access Spacing

Of primary importance to make a new interchange function well into the future is the preservation of traffic capacity. The introduction of driveways and intersections can reduce capacity if they are placed too close to the interchange. The City of Washington Access Management Guidelines help ensure that conflict points are appropriately so they do not negatively impact the progression of traffic as vehicles enter and exit the interstate.

There have been concerns raised at this location regarding this issue primarily because of the number of residential driveways. UDOT was concerned with how the land use would change in the future from residential to something more traffic intensive such as a high-density residential or a commercial zone. Existing residential driveways can often be re-directed to cul-de-sac'd side streets or homes can be acquired to resolve driveway conflicts, but re-zoning for large, retail-focused commercial buildings who want close access to the freeway can be difficult to manage because often these uses require a signal for their access in and out. Therefore, close coordination with land uses will be paramount for an interchange to succeed.

At the Main Street location, access spacing was recommended to have no accesses for the first block, necessitating the purchase of about 4 homes. The cross street at 400 North would be cul-de-sac'd on each side so it would no longer intersect with Main Street. The next block from 400 North to 300 North would have residential driveway accesses but with right turns only, controlled by a raised median. UDOT felt that it would be more proactive to purchase the homes in the second block between 300 North and 400 North instead of dealing with backing out of driveways. If the homes were removed, and the land use changes to commercial, the driveways wouldn't be there for property owners to assume that a driveway would continue to be authorized.

A roundabout interchange creates a different access situation at Main Street since the roundabout creates a boundary between maintaining traffic capacity and efficiency at the ramps, and the formal introduction of a lower speed residential area. Access control probably wouldn't be as much of an issue in the 300 North to 400 North block for this reason.

Favored Alternatives

As reported previously, the team developed several alternatives that were discussed at length. There were several alternatives that may not have been the best overall concept, but they had appealing aspects to the design that would work better with other more favorable alternatives. New alternatives were then created, integrating these aspects to allow a better solution such as better intersection spacing, reduced impacts on the existing neighborhoods, good local road circulation, and reduced ramp and bridge costs.

Each idea was found to belong to one of the following 5 groups:

1) Interchange at Main Street, with a re-alignment of Main Street
2) Interchange at Main Street, while keeping Main Street in its current alignment
3) Interchange at 300 East, with I-15 being re-aligned
4) Interchange at 300 East, with I-15 alignment remaining unchanged
5) A variation of a split interchange

From each group of alternatives, one or two representative concepts were developed. Each of these group concepts will need to be further evaluated for an environmental document so a preferred alternative can be found. From the 30 alternatives, the following Figures 9-15 have merit and were recommended by the project team for further analyzation:

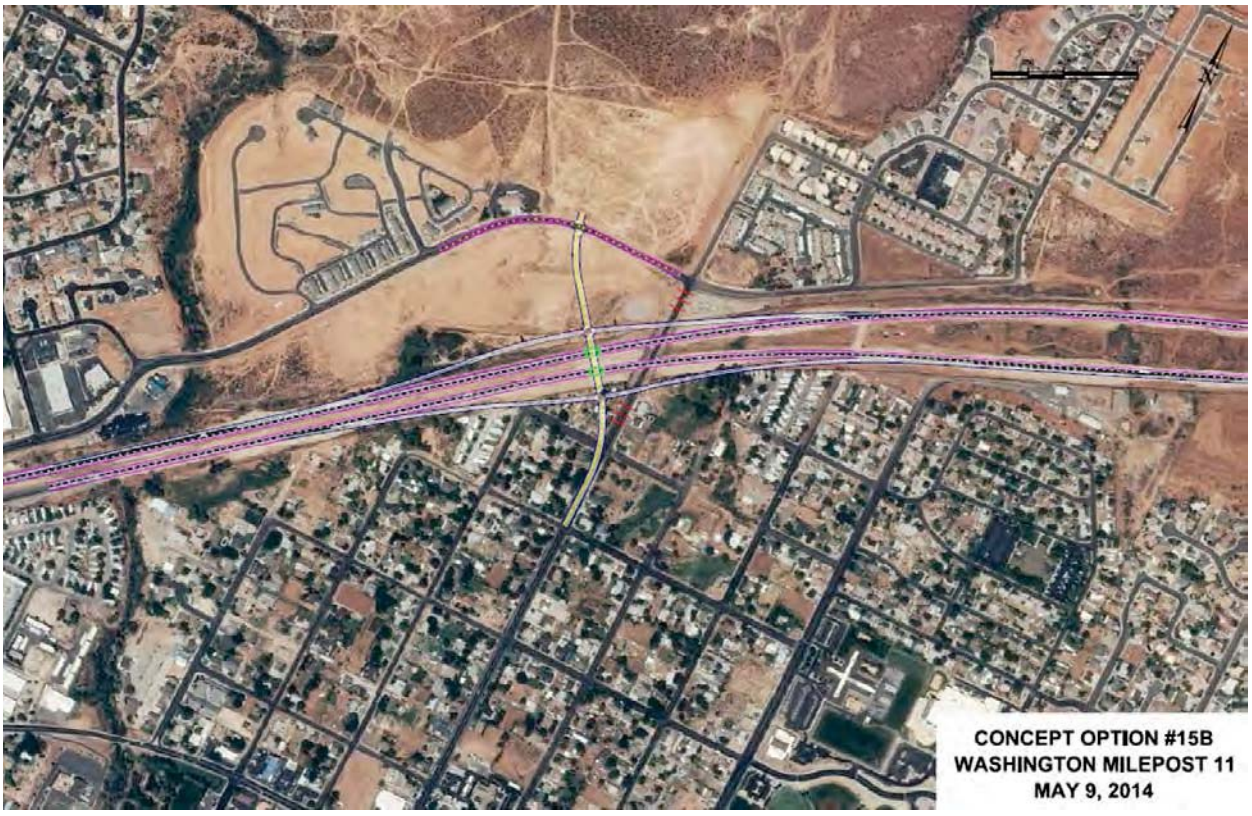


Figure 9: Main Street re-aligned with a standard intersection at Buena Vista Boulevard.

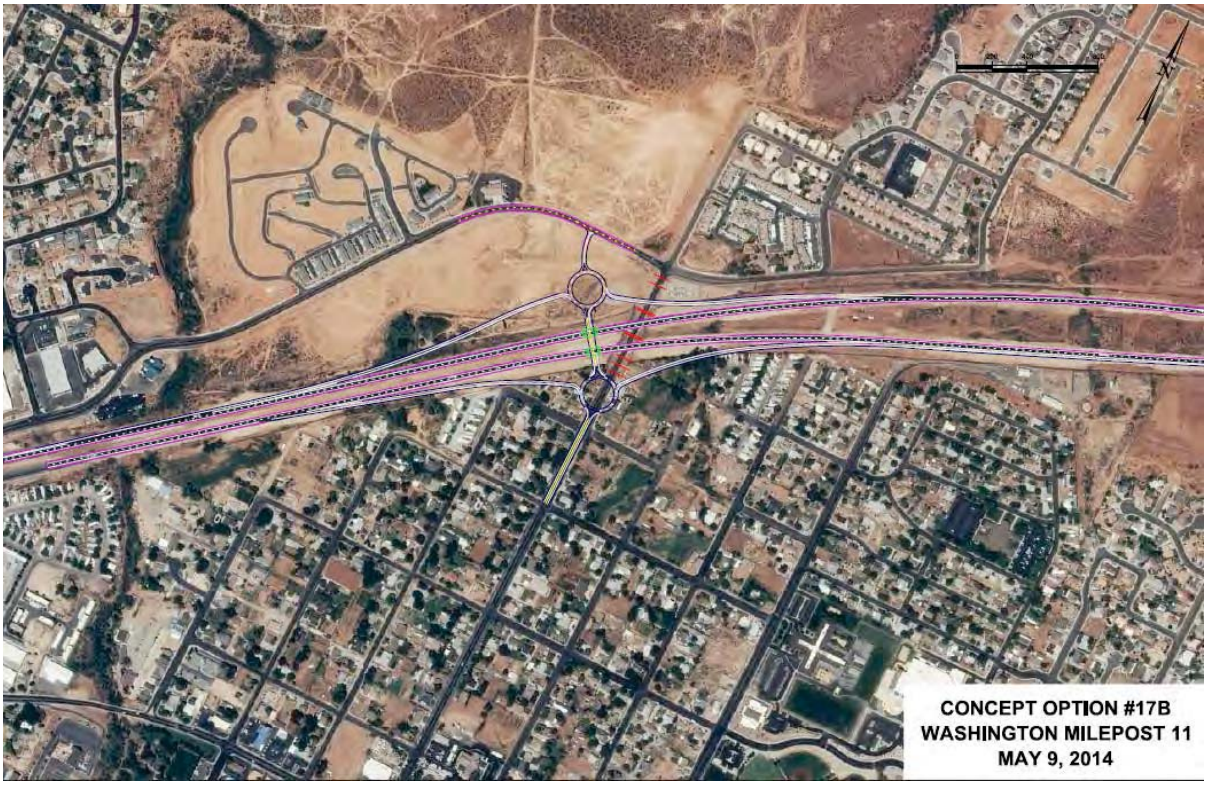


Figure 10: Main Street re-aligned with roundabouts at the ramps on each side.

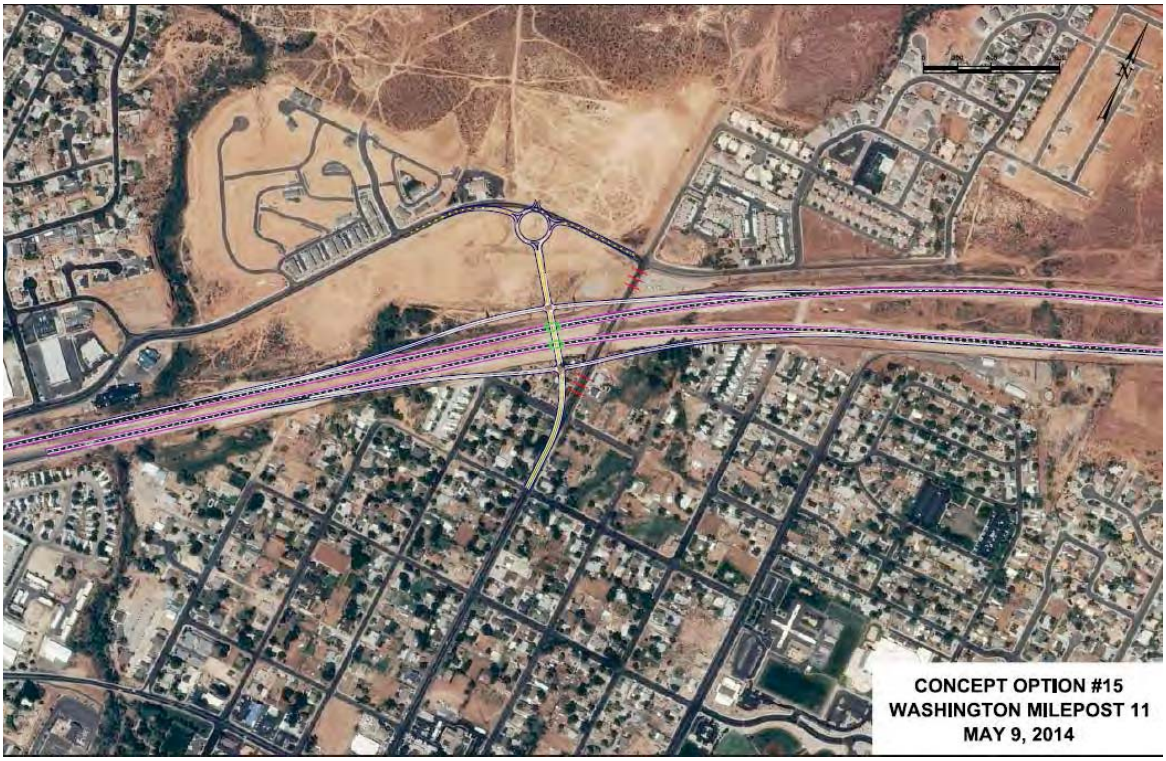


Figure 11: Main Street re-aligned with a roundabout intersection at Buena Vista Boulevard.

Figure 12: Main Street currently aligned with diamond interchange configuration.

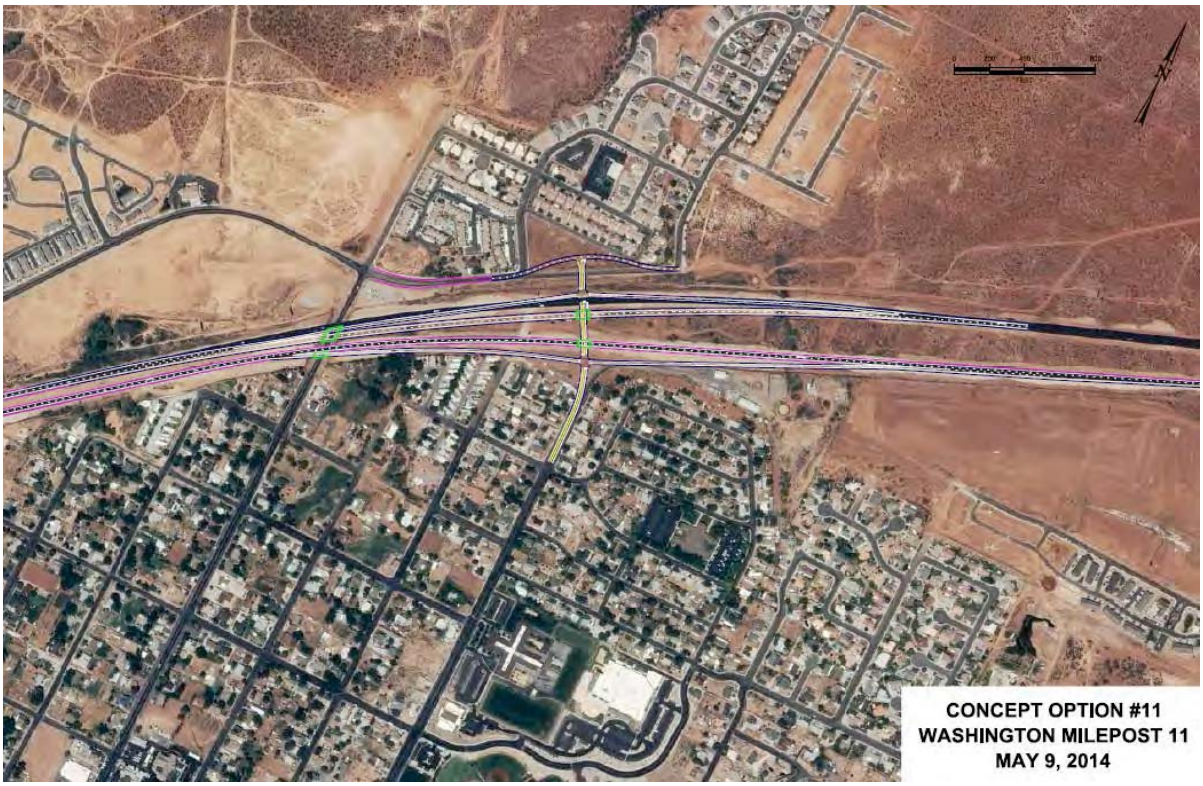


Figure 13: 300 East diamond interchange with southbound I-15 re-aligned.

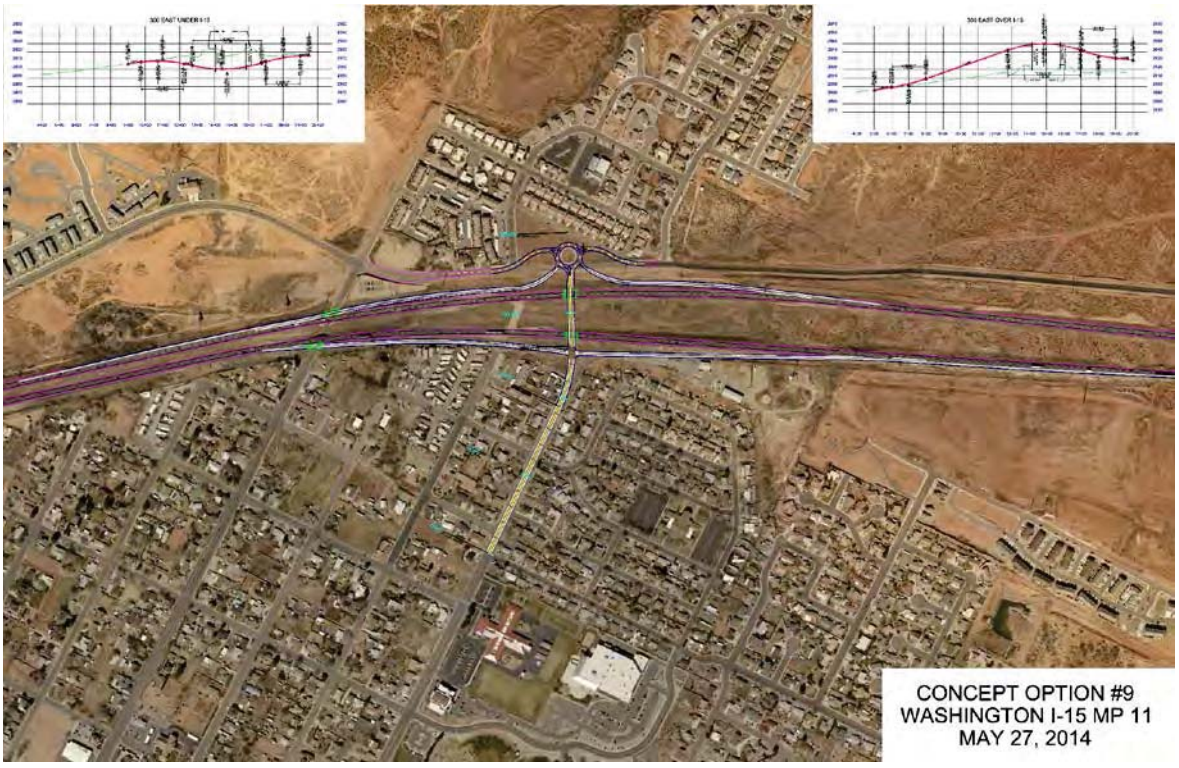


Figure 14: 300 East with diamond interchange on south side and roundabout on north side.

Figure 15: Split interchange concept.

Cost Estimates

To help establish an understanding of the budgetary impacts that these two locations have at Main Street and 300 East, conceptual cost estimates were prepared for each location. The first estimate is for a Realigned Main Street Option, and the second is for 300 East with a Realigned I-15configuration.

COST ESTIMATE #1: REALIGNED MAIN STREET OPTION

Item	Cost Range	Remarks
Construction	$15.0M - $18.0M	
Utilities	$0.5M - $1.5M	
ROW	$1.5M - $3.0M	5-10 relocations at approx. $300k per relocation
PE	$1.0M - $1.5M	Approx. 8% of Construction
CE	$1.5M - $2.0M	Approx. 10% of Construction
Contingency	$1.5M - $2.0M	Approx. 10% of Construction
Total	**$21.0M - $28.0M**	

Assumptions/Risks/Challenges

- Interchange to be constructed as part of the I-15 widening project
- Main Street realigned to cross underneath I-15 (No grade change for I-15)
- I-15 Horizontal Alignment to remain unchanged
- Tight Diamond or Diamond with Roundabouts type interchange
- New Structures for I-15 over Main Street
- Minimal Reconstruction of Buena Vista (West Frontage Road)
- No impacts to the Power Sub Station
- ROW acquistions of 5-10 parcels, depending on interchange type and access control
- Does not include construction of new frontage roads
- Utility impacts unknown
- Existing Main St structures may remain as Bike/Ped crossing
- Auxiliary Lanes will be constructed between adjacent interchanges

COST ESTIMATE #2: REALIGNED 300 EAST OPTION

Item	Cost Range	Remarks
Construction	$22.0M - $27.0M	Includes reconstruction of I-15
Utilities	$0.5M - $1.5M	
ROW	$2.5M - $4.5M	9-15 relocations at approx. $300k per relocation
PE	$1.5M - $2.0M	Approx. 8% of Construction
CE	$2.0 M - $2.5M	Approx. 10% of Construction
Contingency	$2.0M - $2.5M	Approx. 10% of Construction
Frontage Road	$5.0M - $10.0M	Relocation of Buena Vista Boulevard through/around existing neighborhood
Total	**$35.5M - $50.5M**	

Assumptions/Risks/Challenges

- Interchange to be constructed as part of the I-15 widening project
- 300 East realigned to cross underneath I-15
- I-15 to be realigned and reconstructed for ~1.0 to 1.5 miles (to accommodate interchange)
- Tight Diamond or Diamond with Roundabouts type interchange
- Geometric & Operational Challenges on North side due to close proximity of Frontage Road & properties
- New Structures for I-15 over 300 East
- Realignment and Reconstruction of approximately 0.5 miles of Buena Vista (West Frontage Road)
- No impacts to the Power Sub Station
- ROW acquistions of 9-15 parcels, depending on interchange type and access control
- Does not include construction of new frontage roads
- Utility impacts unknown
- Existing springs in I-15 median will need to be addressed
- Existing Main St structures to remain
- Auxiliary Lanes will be constructed between adjacent interchanges

STAKEHOLDER INPUT

With the concern that the City has over the intersection of Green Springs Drive and Telegraph Street and that a possible piece of the solution to relieve future congestion lies with a new interchange, the City proactively began the process to evaluate the concept of this new interchange. Horrocks Engineers met with the City to establish the scope of work and the study methodology. Due to the regional significance of this interchange, a discussion on the need to

coordinate with UDOT and the Dixie MPO was determined to be very important for the success of the project.

Early input and concurrence was received by the Dixie Team at UDOT and the Dixie MPO staff for the need of the interchange. Alternatives for the interchange were developed and discussed. After an initial ranking of the alternatives, the team then met with Eric Rasband, UDOT Planning, to discuss if he would be supportive of the interchange moving ahead with further documentation and planning. He shared his thoughts about what the project should achieve and what kind of spacing and access guidelines should be followed. The team then met with UDOT Traffic and Safety, John Leonard, to ascertain any issues that he might have and after some discussion about the purpose of the project, signing, weave distances, and alternative preferences, it was his opinion that it should move ahead and that he would inform the Federal Highways Administration staff of the project.

After these important steps were taken, a meeting was then held with the UDOT Region Four leadership to share with them the history of the project, what has taken place, the data that had been gathered, and the reactions from the UDOT staff from previous meetings. State project prioritization was discussed and Horrocks Engineers suggested preparing a ranking of this interchange as part of this study, which has been done. Funding for the project has begun with the City with the anticipation that State and/or Federal participation will be available based on its ability to address congestion on the roadway system in Washington City.

Based on this study, this project will now move into the environmental document stage. It is assumed that either a Categorical Exclusion or an Environmental Assessment will need to be prepared prior to moving into an Interchange Access Change Report.

Further Considerations

The team has discussed several issues with stakeholders that have been important in the planning of this interchange. Many of these issues for future consideration should be mentioned so they are not neglected. They are listed in this section.

- The City is interested in determining where the interchange will be before settling on any development plans.
- We should consider bikes and pedestrians for access, as each type of intersection deals with it differently.
- UDOT felt that since this interchange could morph to something larger in the future, choose the one with the biggest footprint so it can be converted to a higher capacity solution in the future.
- UDOT thought that a mitigating measure to students walking to the school could be a skybridge. This is more of a systemic approach, working deeper into the road system with

300 East as it goes to the south. The school is scheduled for a major remodel so access can change, but it is a no-bus school so pedestrians will be a huge issue. A "no left-exit" can be proposed to simplify access.

- We want to do this interchange in conjunction with the 3-lane I-15 expansion to save costs and would be more convenient to the city so disturbance would only happen once.
- At 300 East, take area within the median and ease the MOT requirements, saving money and time.
- UDOT thought that a split interchange seems ponderous and is not very friendly to those unfamiliar with the area. Some staff don't recommend it.
- UDOT felt that there isn't much against the idea of an interchange at Milepost 11. There really isn't much of a signage issue, some things may require overhead signs, etc.
- Be sure to work with the MPO to get the interchange on the Long Range Plan and on the Road Masterplan.

MILEPOST 11 INTERCHANGE CONCEPT STUDY CONCLUSIONS AND RECOMMENDATIONS

Upon investigating the possible placement of a new interchange on I-15 at Milepost 11, it is concluded that there is sufficient information that indicates an interchange would be a great benefit to Telegraph Road and Green Springs Drive intersection and Milepost 10. It was also determined that an interchange would meet the design criteria where an interchange at either Main Street or 300 East. There were no fatal flaws in the concept that would prevent it from fitting at either location. In addition, the new interchange would maintain the integrity of I-15.

The two locations that were targeted in this study for an interchange both have positive and negative aspects to its placement. Upon holding rigorous discussions with stakeholders, a list of strengths and weaknesses of each location are listed below:

<u>300 East</u>

Strengths:

- There is a perceived benefit of direct access from I-15 to Washington Fields
- This connection would allow direct access to important community sites on 300 East such as the Washington City Community Center, Washington Elementary School, the Washington City Cemetery and the Washington Branch Library.
- The wide freeway median could ease the MOT requirements, saving money and time.
- The wide freeway median could provide additional space to allow other interchange geometric opportunities.

Weaknesses:

- The vertical clearance requirements will impact more of the neighborhood, creating difficult grading issues on both sides of the freeway.
- There is a tight space constraint on the north side of the freeway unless buildings are displaced to allow more room for ramps and circulatory roads.
- The roadway system continuity is less favorable on the north side of the freeway.

Main Street

Strengths:

- The connectivity of the supporting street network is favorable with Main Street continuing to the north to Washington Parkway.
- This location respects the N/A line without having to re-align I-15.
- Spacing of adjacent intersections can be made to work since there is more room on the north side of the interchange.
- The ample room on the north side of the freeway will allow analyzation of several geometric configurations in order to find the most efficient concept.
- This location will require addressing the functionally obsolete bridges at Main Street under I-15.
- The vertical clearance should be more easily met by going under I-15.
- Main Street will divert more vehicles from the Milepost 10 interchange.
- Main Street is anticipated to have higher volumes on its ramps.

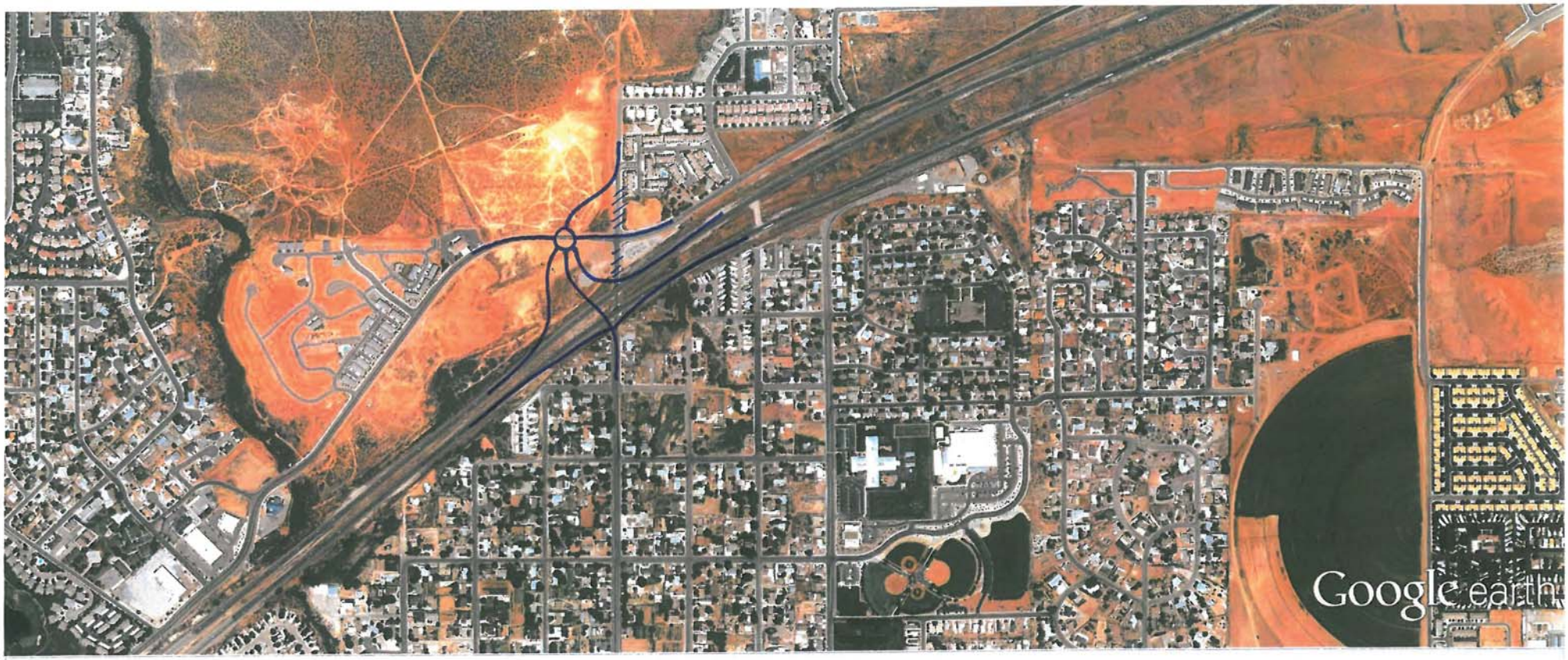
Weaknesses:

- The residential neighborhood on the south side will create access issues. Several houses will have to be acquired to resolve current driveway connections.
- Main Street does not currently have direct access to the Washington Fields area. It is circuitous to connect to 300 East and cross the Virgin River.

The Team recommends that the concept of a new interchange with I-15 at Milepost 11 move ahead. The next steps would be to prepare an environmental document and an IACR for further consideration of the improvement by UDOT and FHWA.

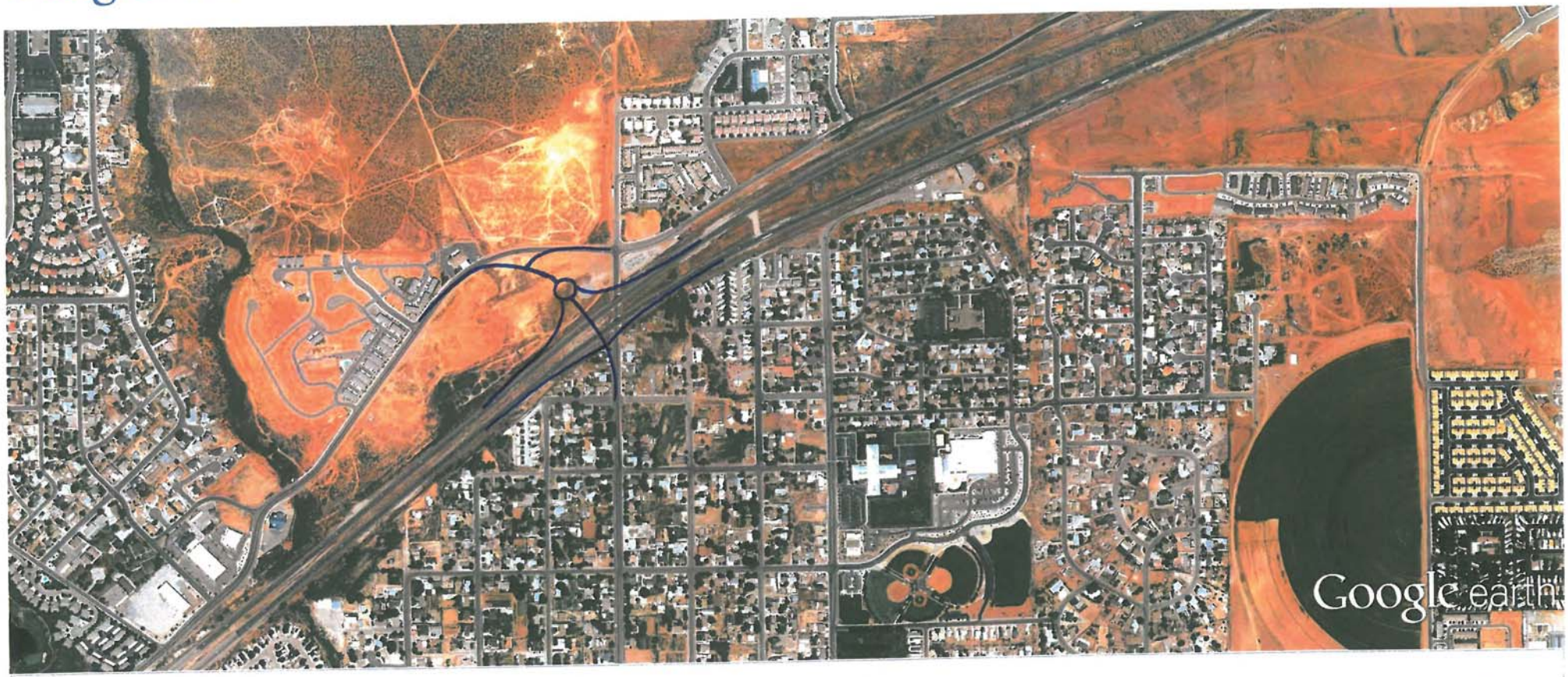
APPENDIX

INTERCHANGE ALTERNATIVES



Roads

Google earth



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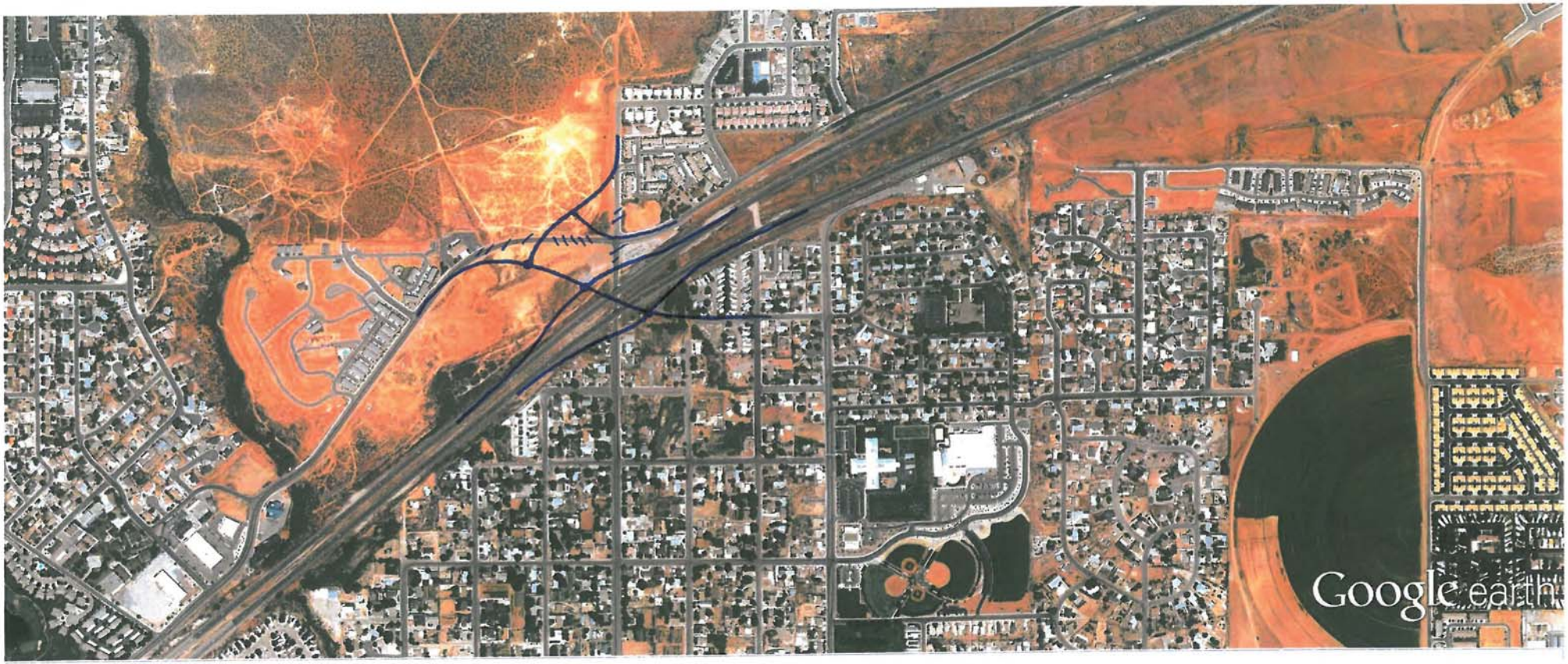
Roads



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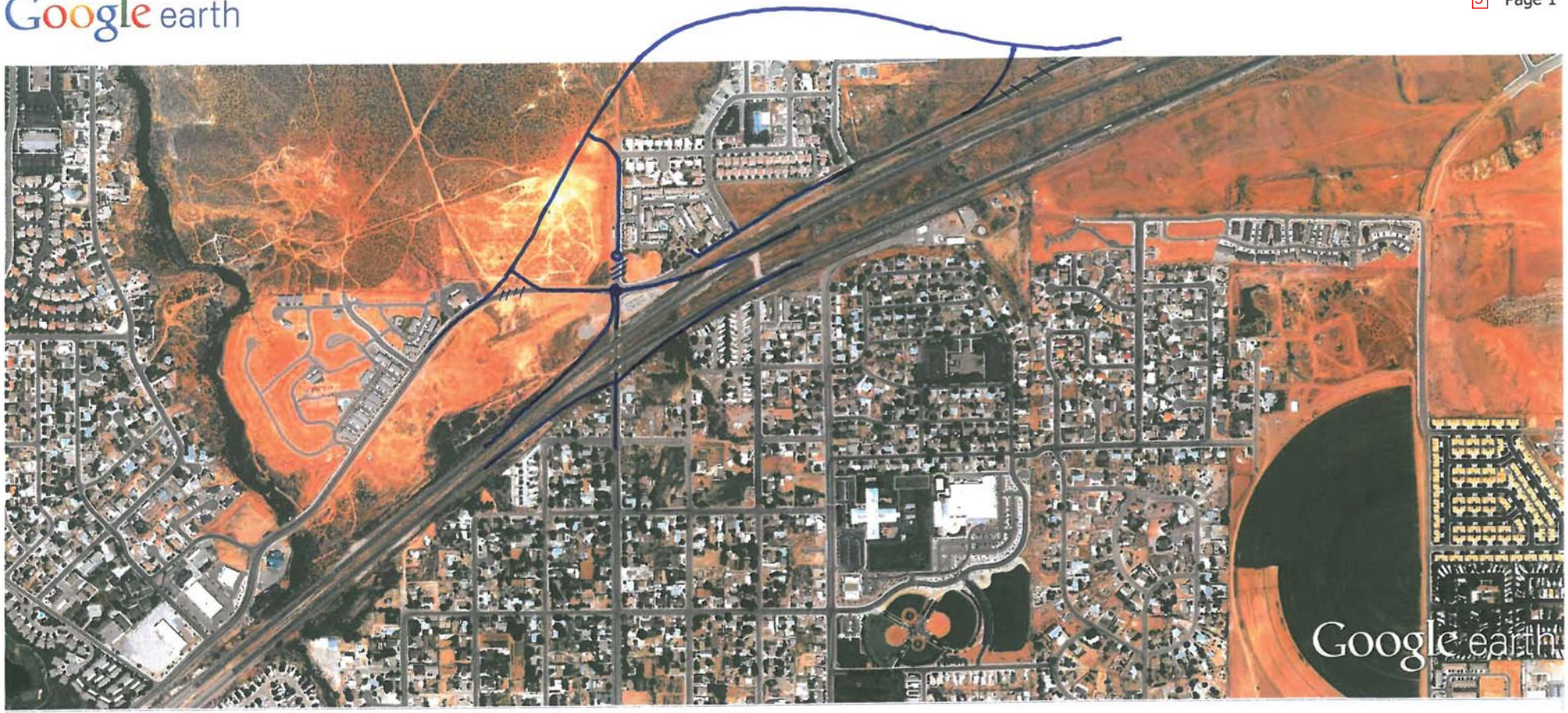
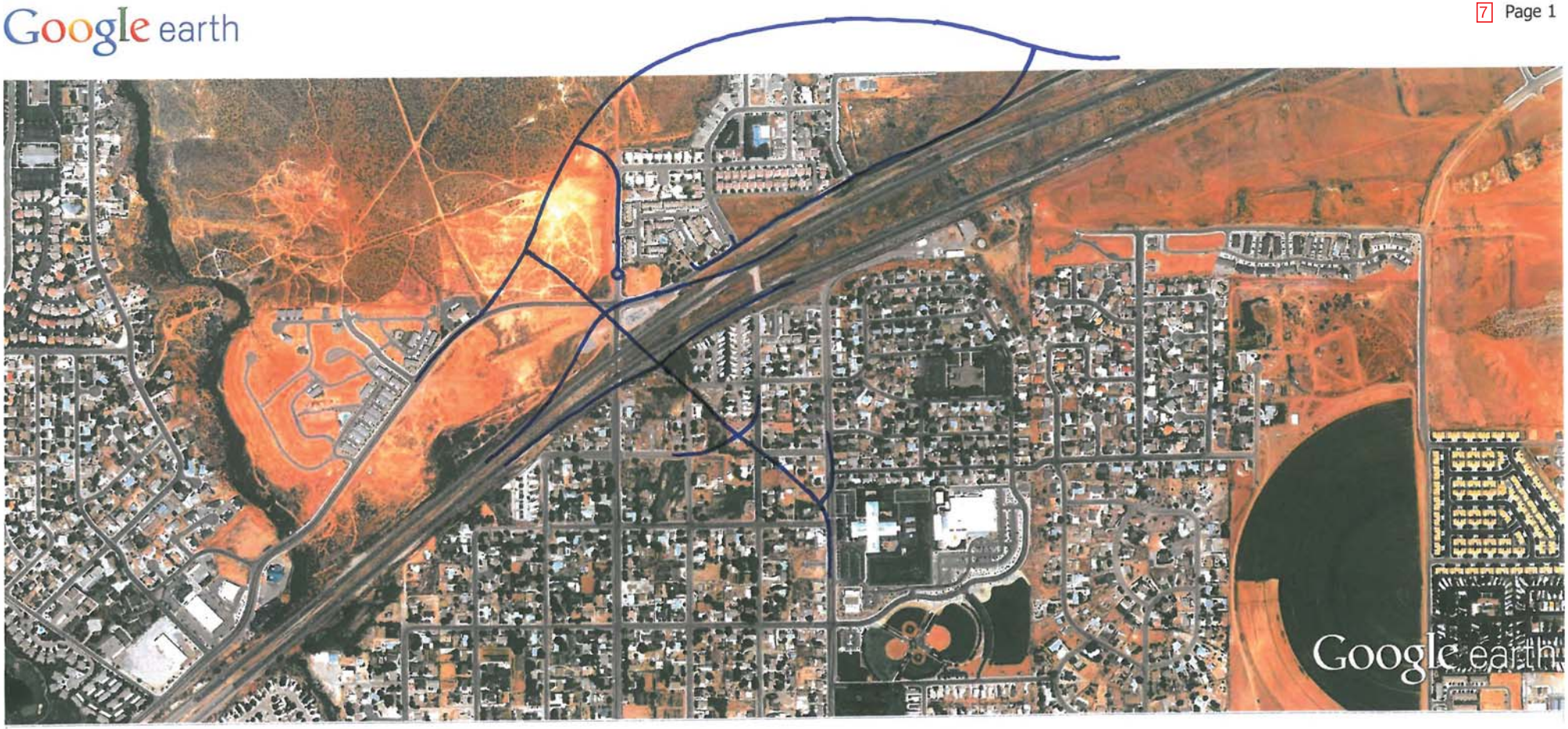
Google earth



Roads

Roads



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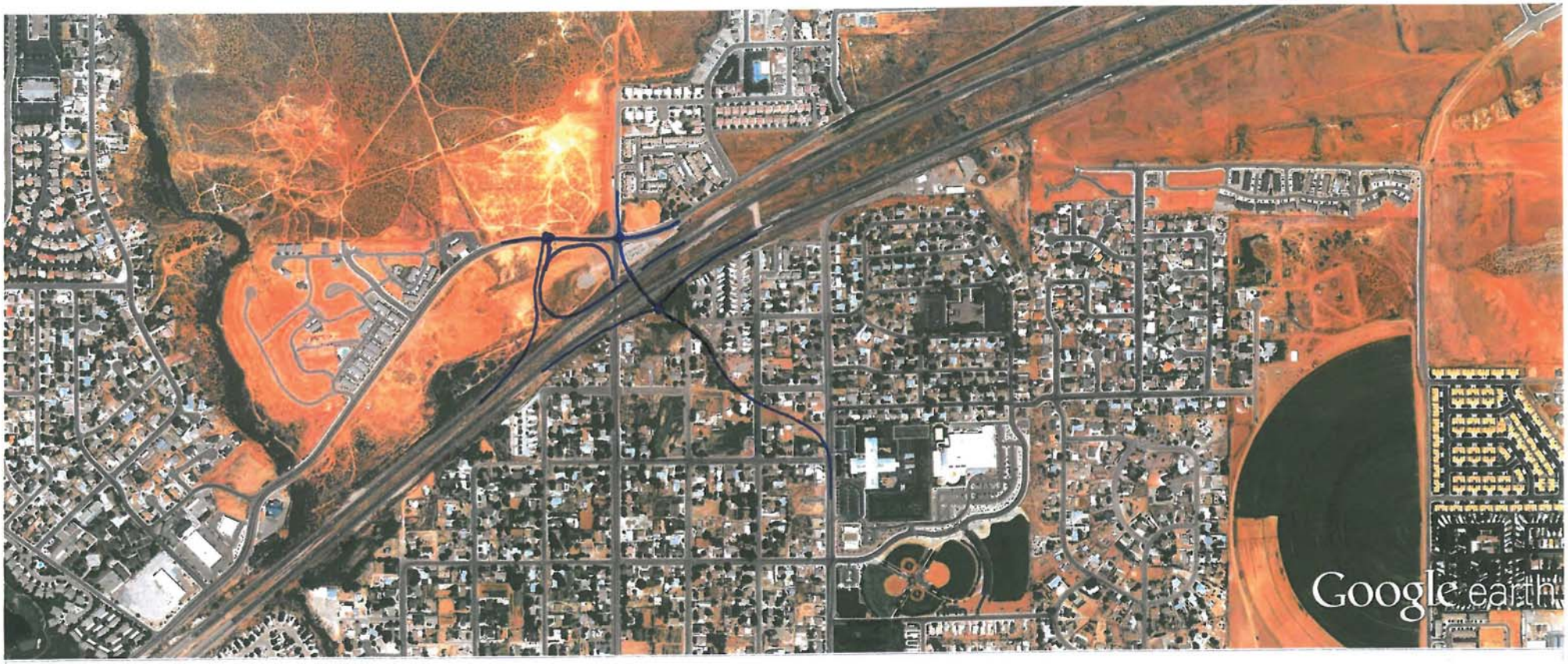

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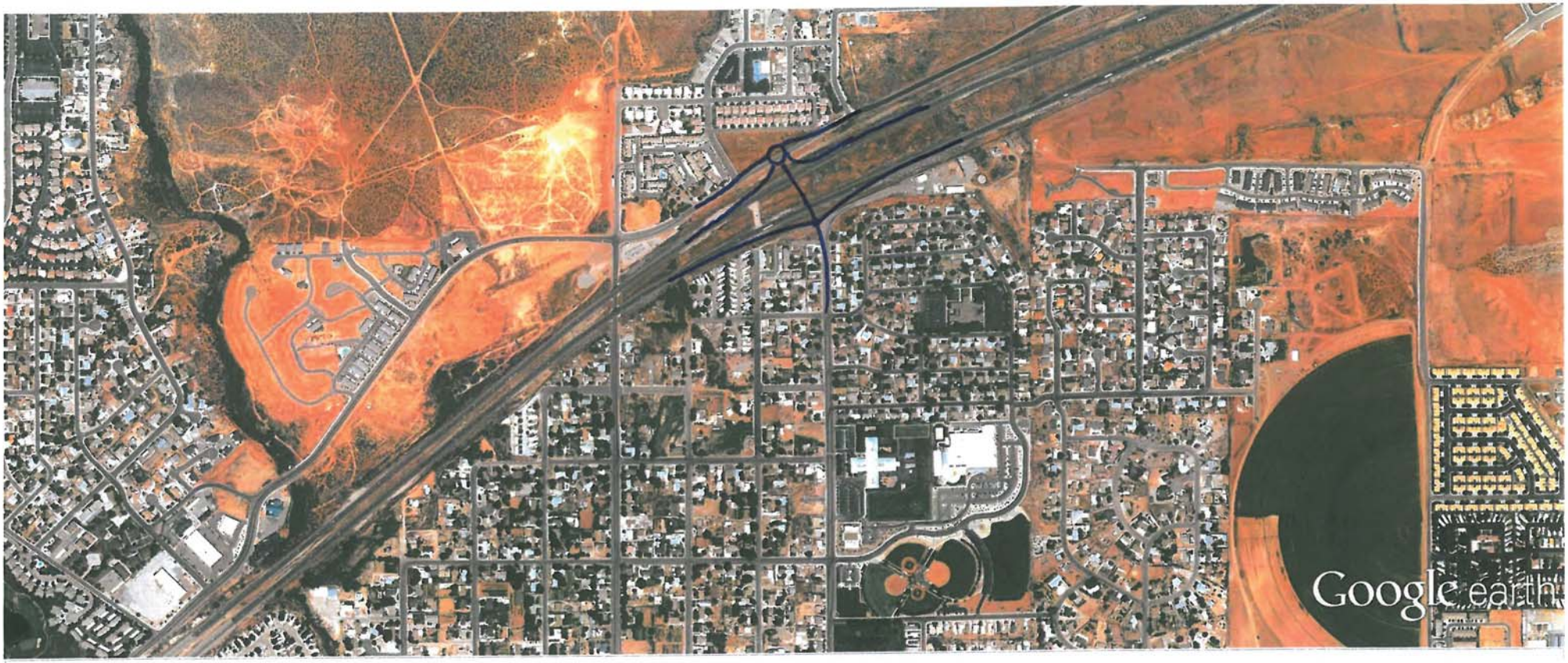

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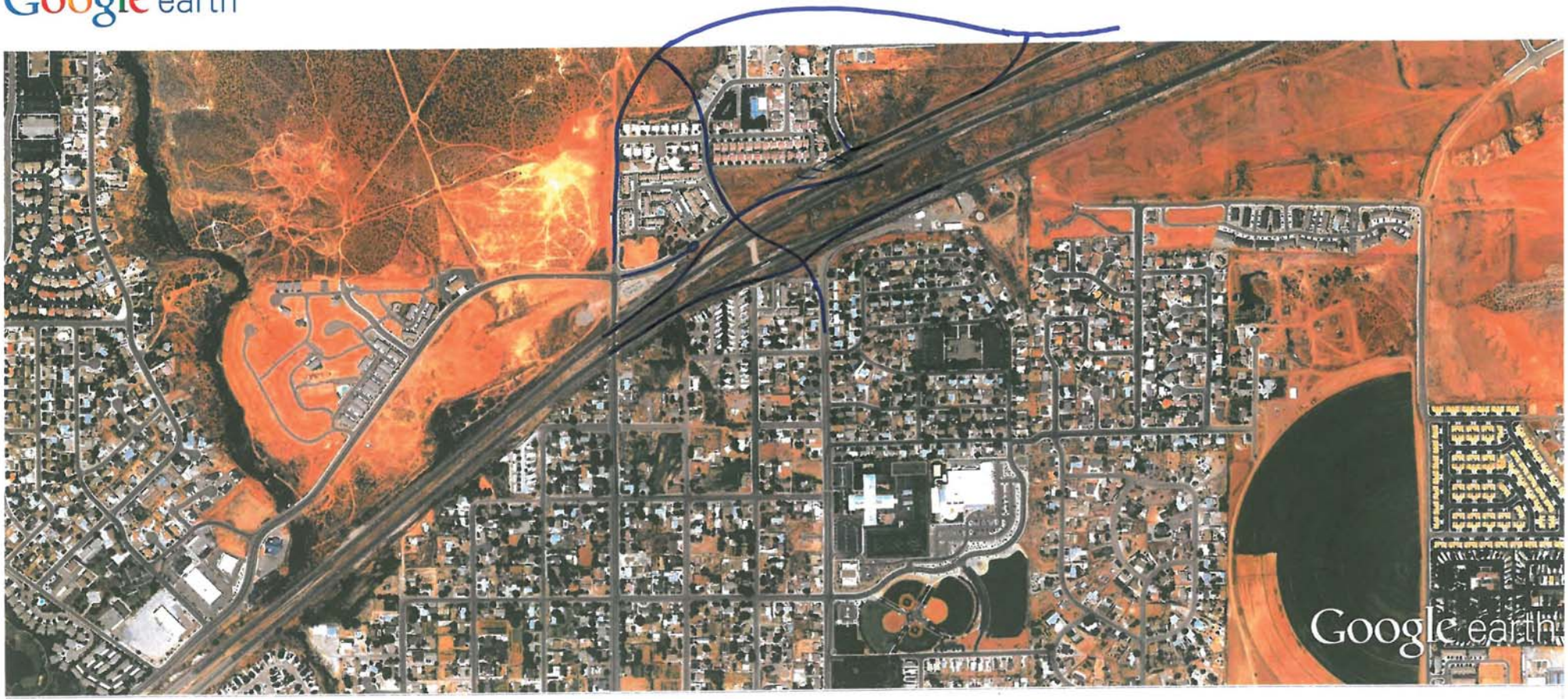

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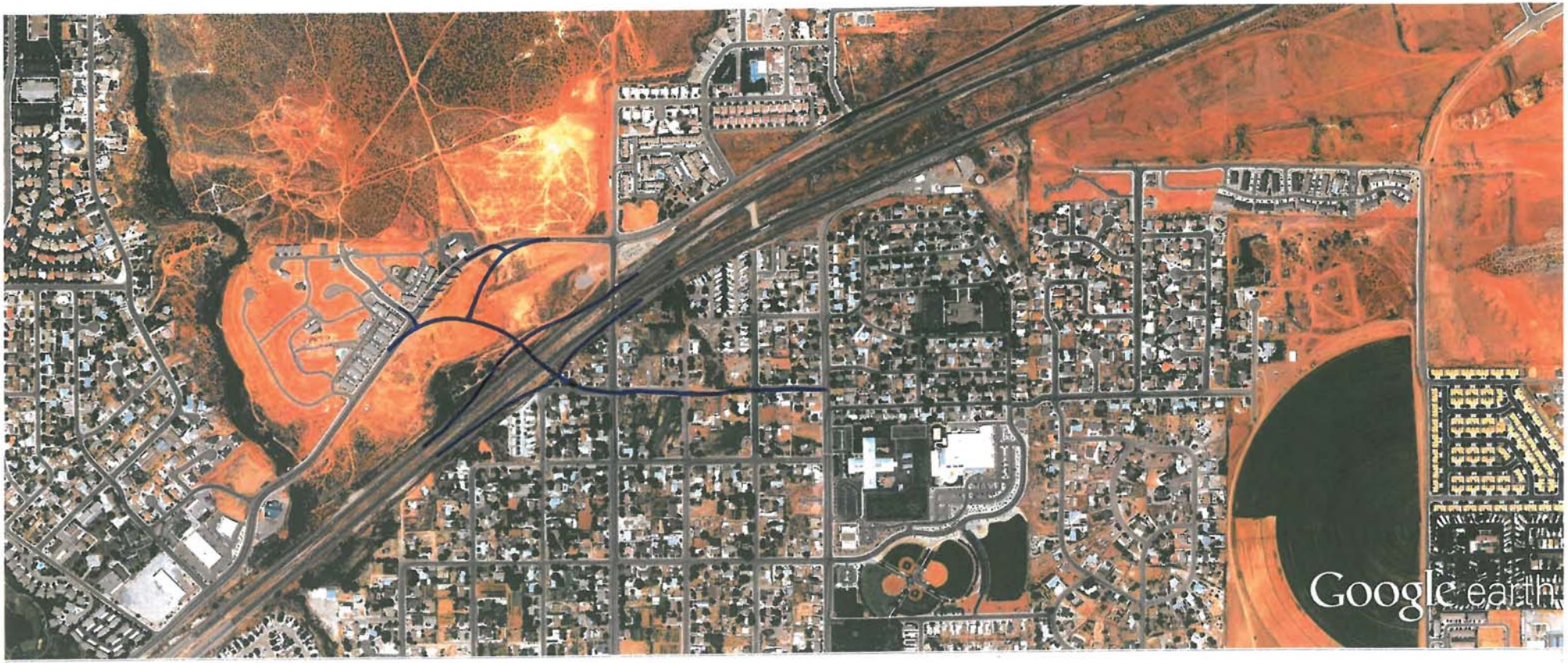
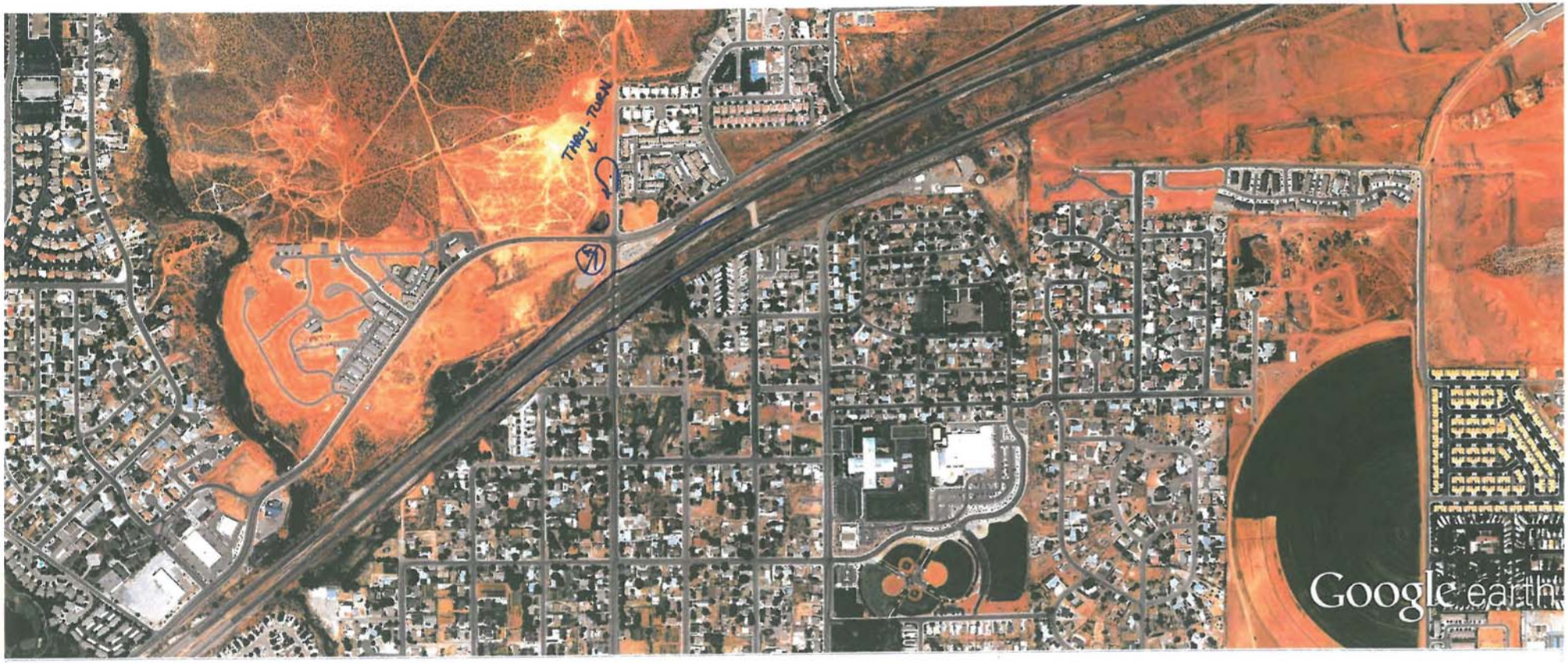


Roads

Roads

Google earth

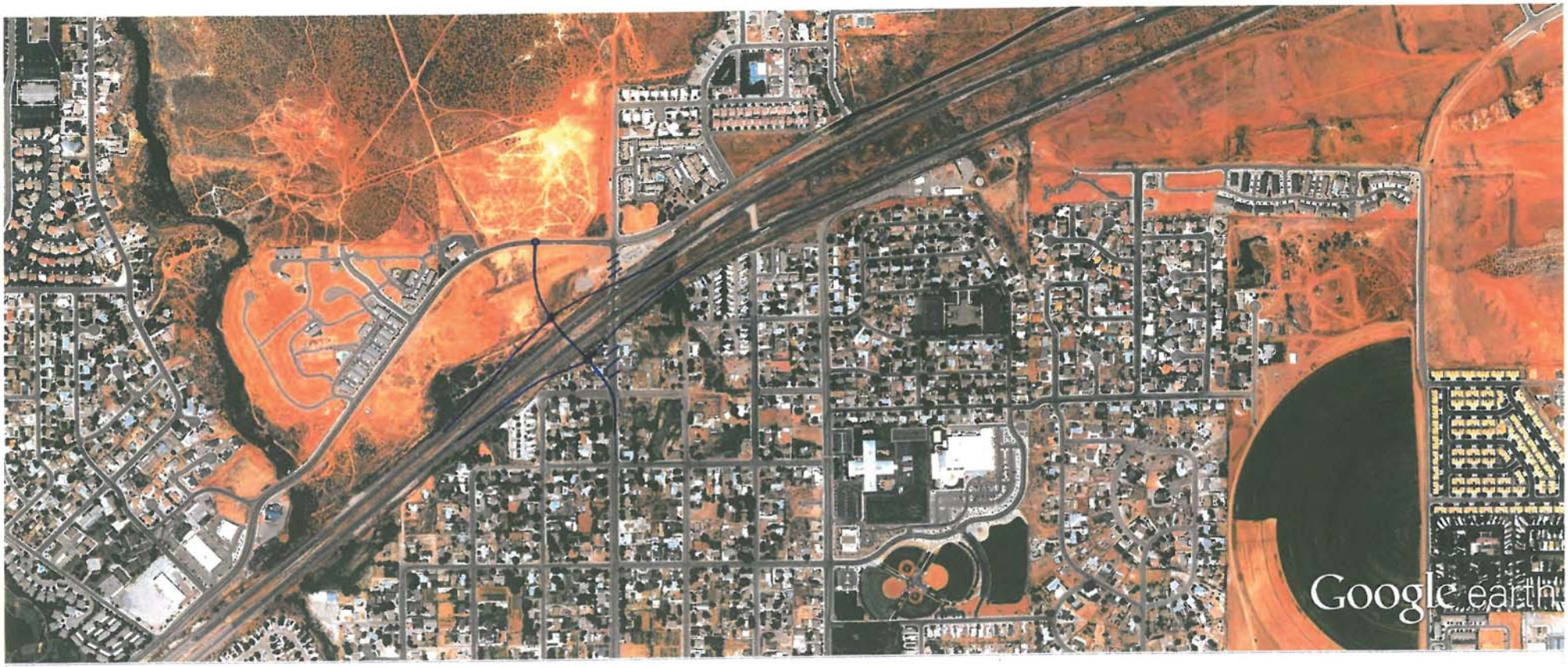


Roads

Google earth

Roads

Google earth



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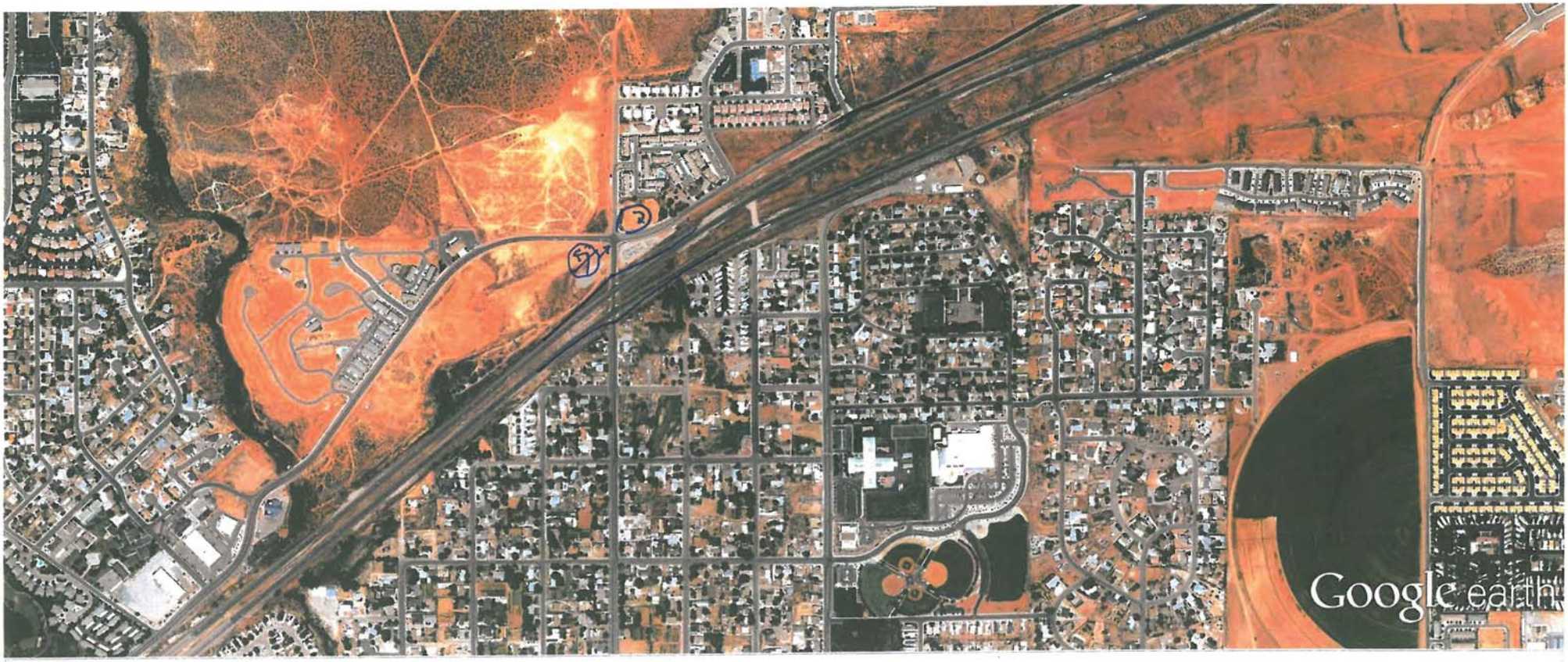

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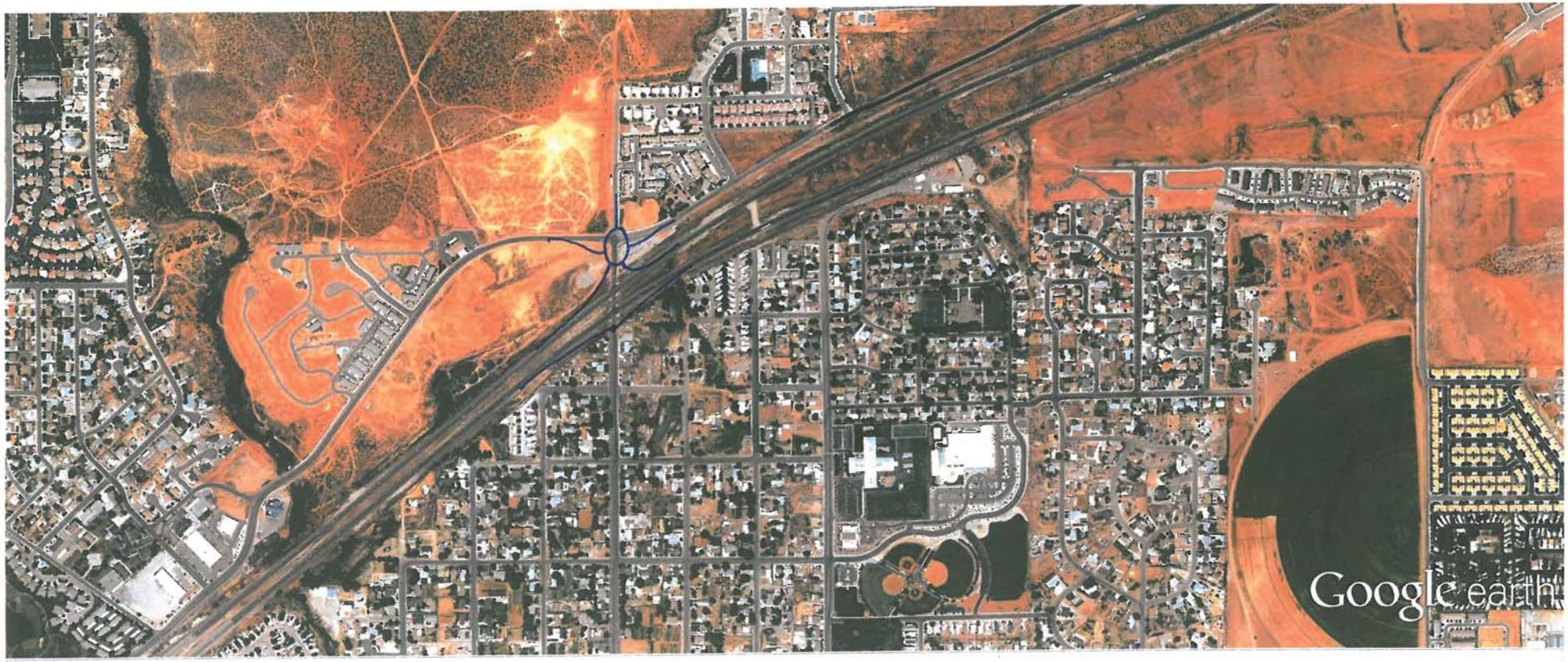

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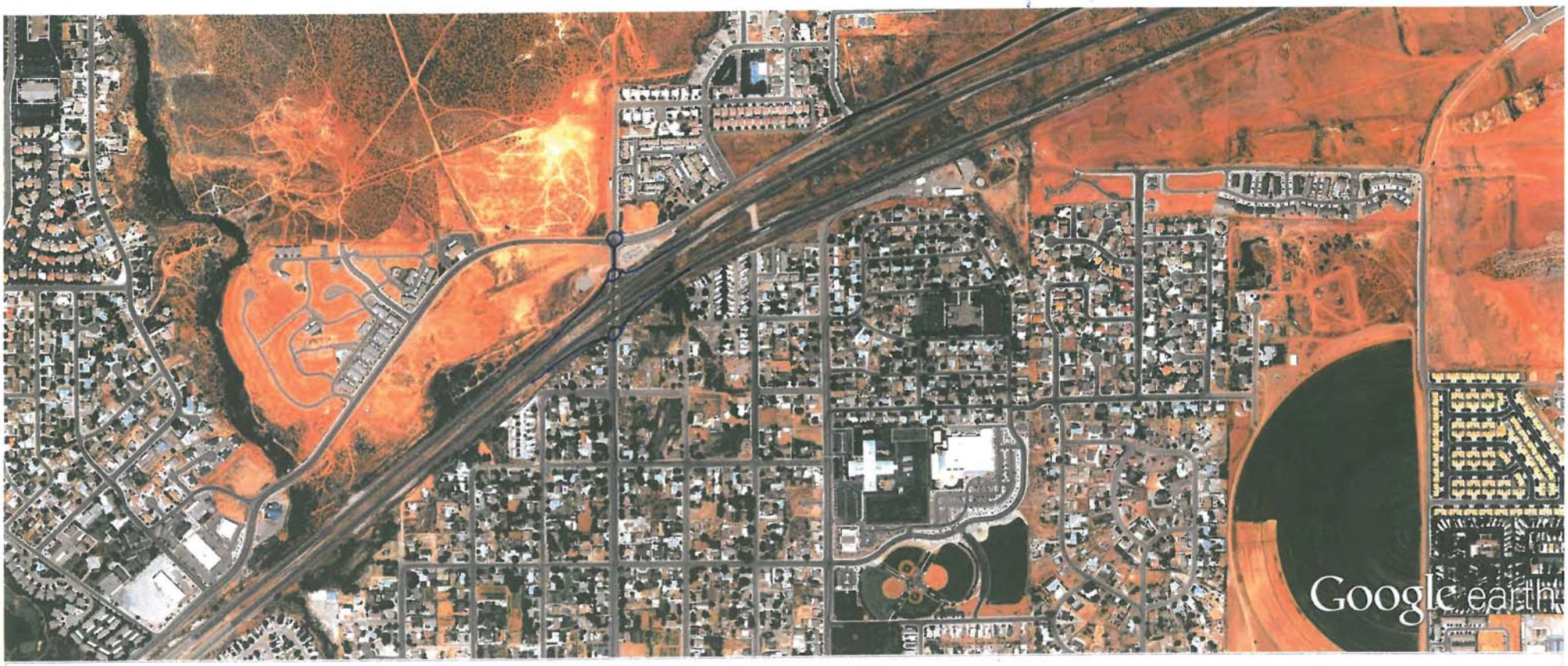

Roads

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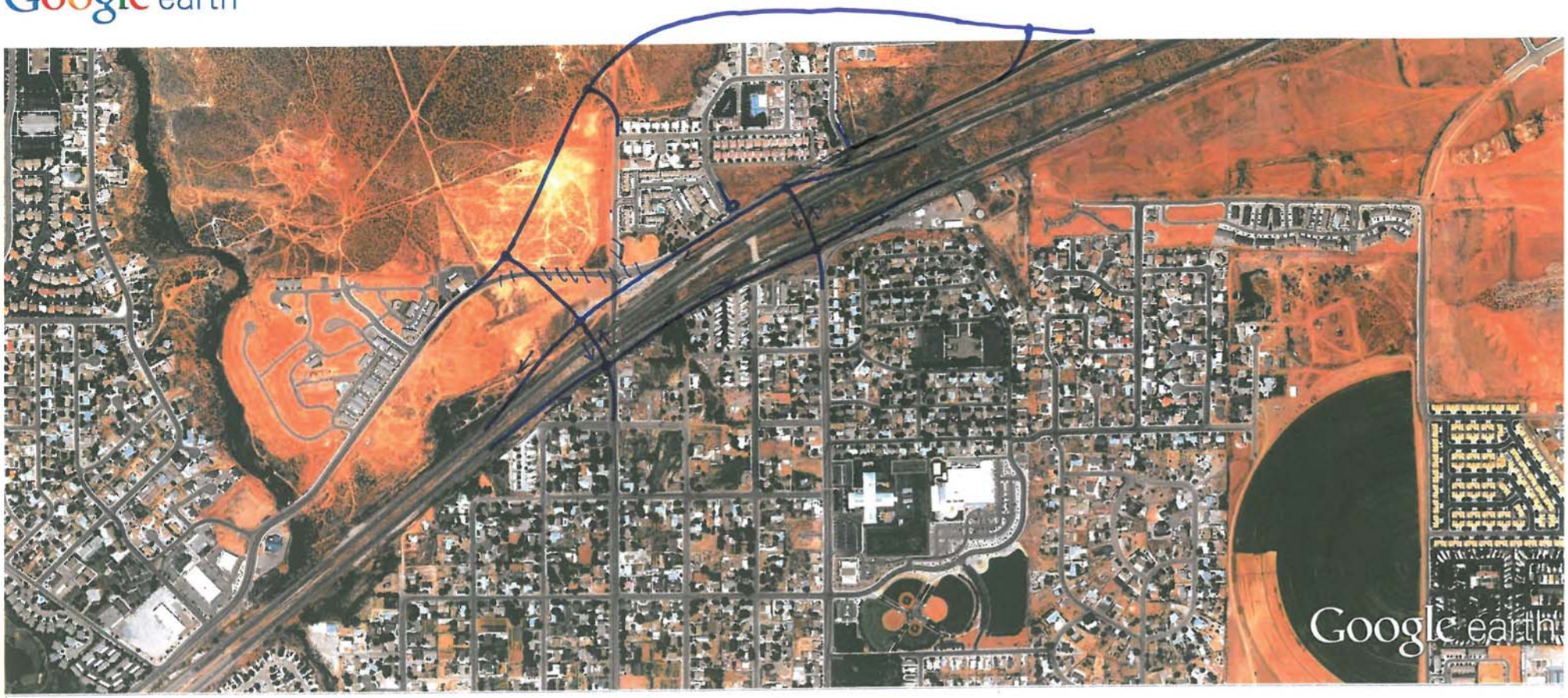

Roads


E Arrowweed Dr
Gail Way
E Buena Vista Blvd
Rolling Hills Rd
E Todd Pl
Canal Springs Dr
Veterans Memorial Hwy
Sun Rock Way
Huntington Hill Rd
Urie N Dr
E Rocco Rd
E Mangum Rd
Urie W Dr
Urie E Dr
E 420 N
Bulloch Dr
W 400 N
E 400 N
W 300 N
N 100 W
N 100 E
N 200 E
N 300 E
N 600 E
W Buena Vista Blvd

N Scenic Dr W
N 600 E
Ute E Dr
E Mangum Rd
E Rocco Rd
Ute N Dr
E 420 N
Bullock Dr
N 300 E
E 400 N
N 200 E
Huntington Hill Rd
N 100 E
Veterans Memorial Hwy
N 400 W
N 300 W
N 100 W
W Buena Vista Blvd
Sun Rock Way
E Buena Vista Blvd
E Arrowweed Dr
Gail Way
Rolling Hills Rd
Foxboy Dr
E Total Pl
Camel Springs Dr


E Arrowweed Dr
Gail Way
E Buena Vista Blvd
Rolling Hills Rd
E Todd Pl
Camel Springs Dr
Sun Rock Way
Veterans Memorial Hwy
Huntington Hill Rd
Urie N Dr
E Rocco Rd
E Mangum Rd
Urie W Dr
Urie E Dr
E 420 N
Bulloch Dr
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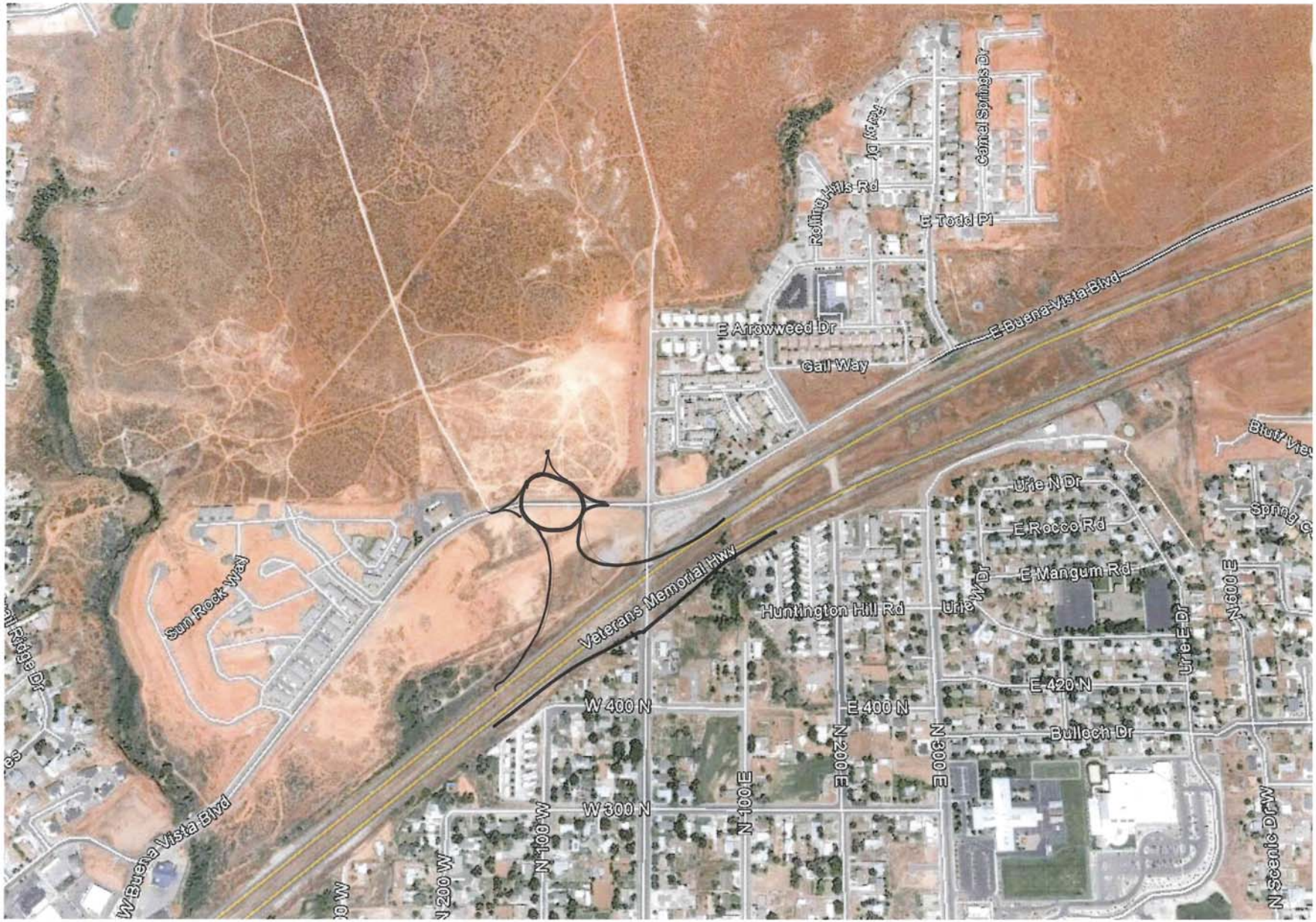
N 200 E
N 300 E
N 600 E
W Buena Vista Blvd
N Scenic Dr W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Sun Rock Way
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E Rocco Rd
E Mangum Rd
Urie W Dr
Urie E Dr
E 420 N
Bulloch Dr
W 400 N
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N 200 E
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N Scenic Dr W

N Scenic Dr W
N 600 E
Ute E Dr
E Rocco Rd
E Mangum Rd
Ute N Dr
E 420 N
Bullock Dr
Ute W Dr
N 300 E
E 400 N
Huntington Hill Rd
N 200 E
N 100 E
E Arrowweed Dr
Gail Way
Rolling Hills Rd
Ruby Dr
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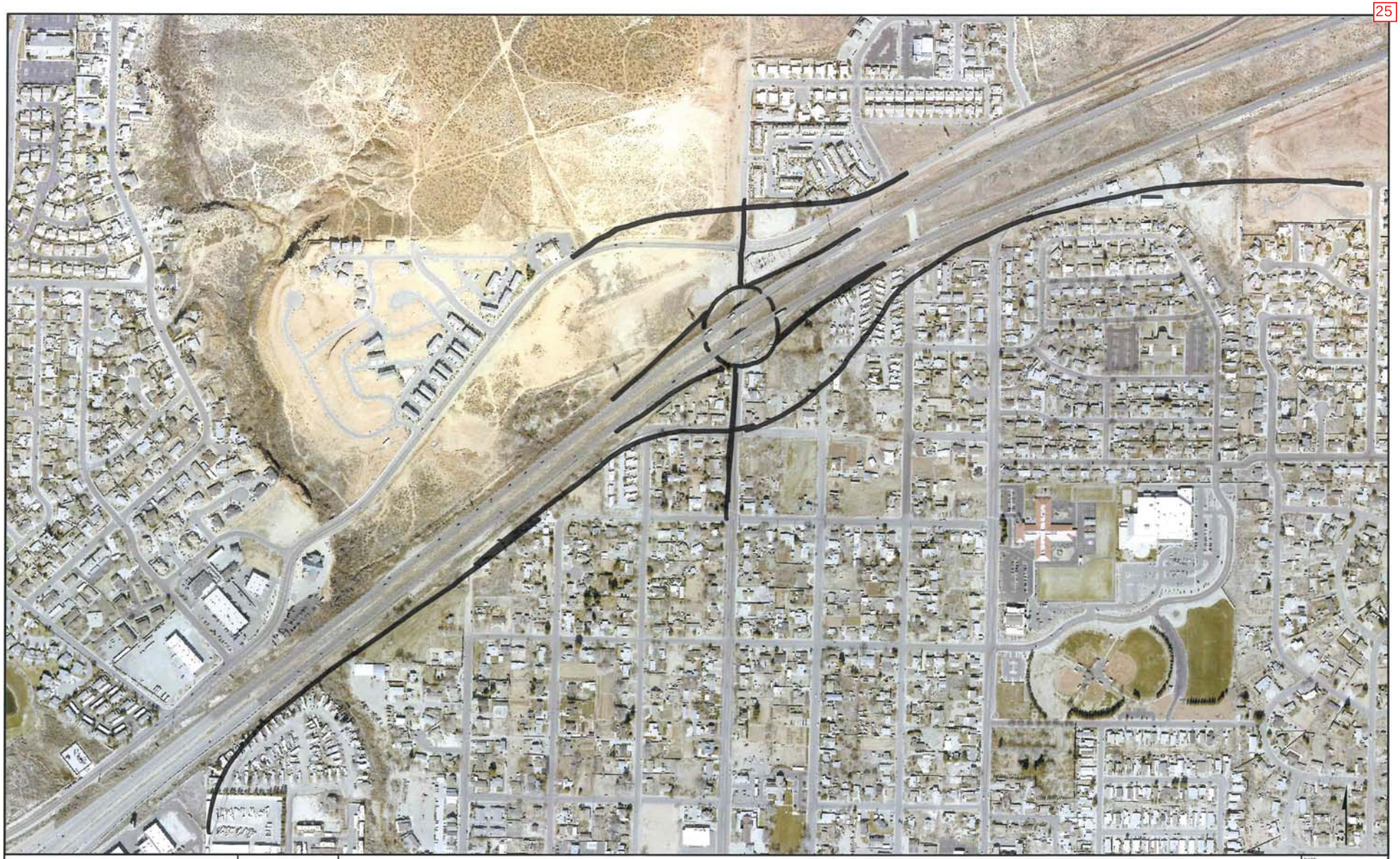
Sun Rock Way
W Buena Vista Blvd



HORROCKS ENGINEERS
555 S. Bluff St
Suite 300
St. George, UT 84770
(435) 986-7888

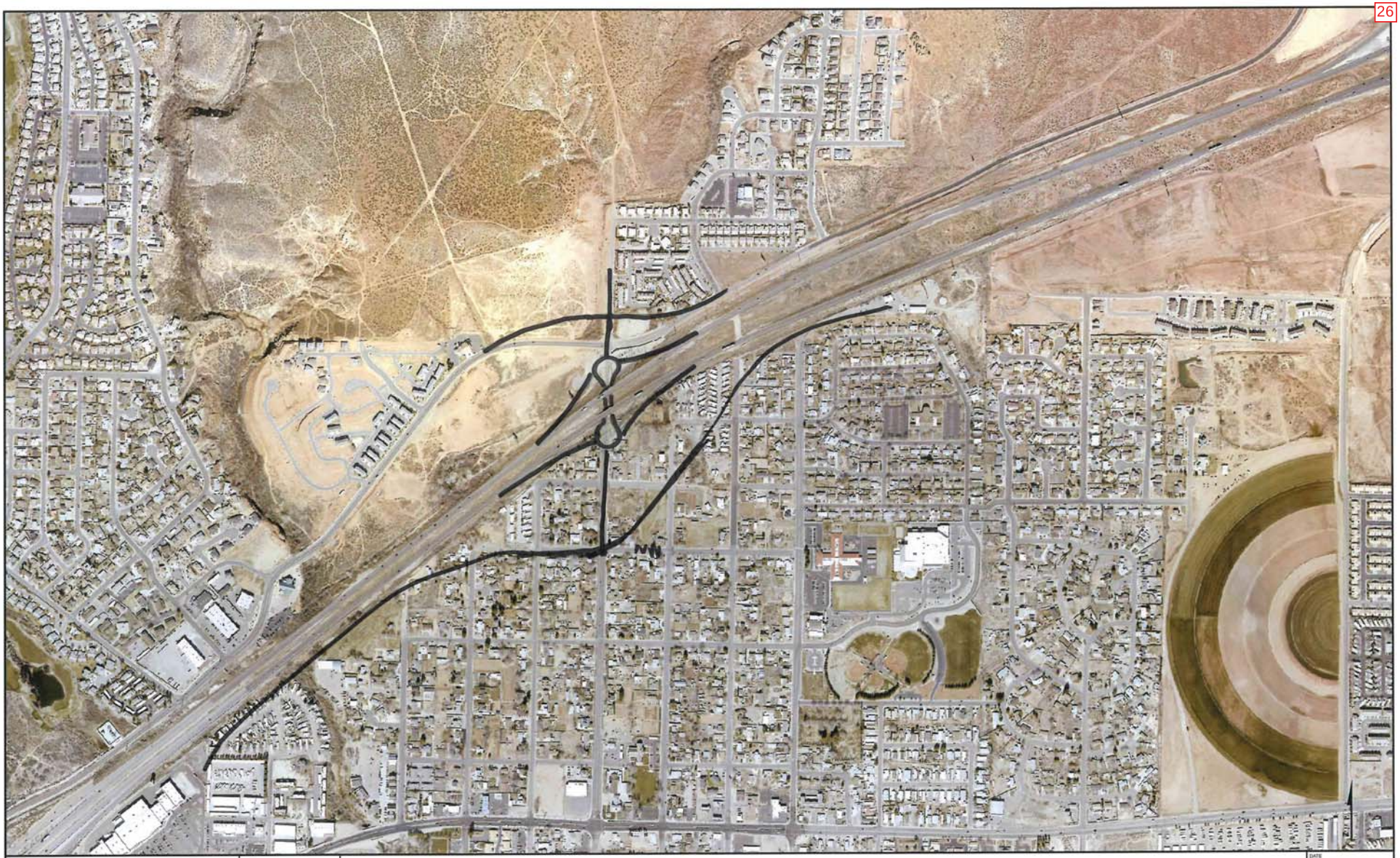
Exit 11 Feasibility Study

Option

DATE 3/31/2014

DRAWN

Figure 2



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Exit 11 Feasibility Study

Option

DATE 3/25/2014

DRAWN

Figure XX

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Exit 11 Feasibility Study

Option

DATE 3/31/2014

DRAWN

Figure 2

HORROCKS ENGINEERS

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Suite 300
St. George, UT 84770
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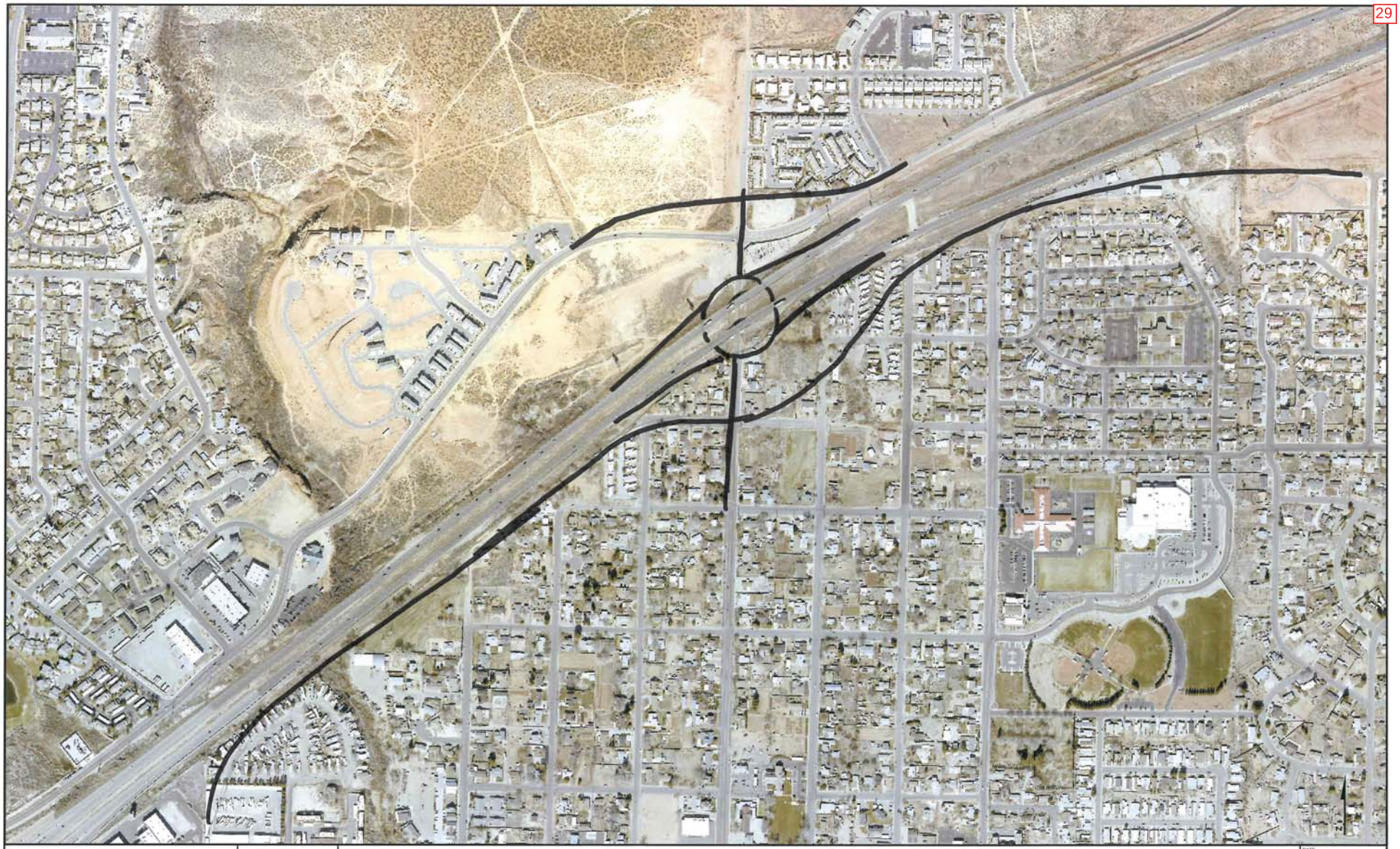
Exit 11 Feasibility Study

Option

DATE 3/25/2014

DRAWN

Figure XX



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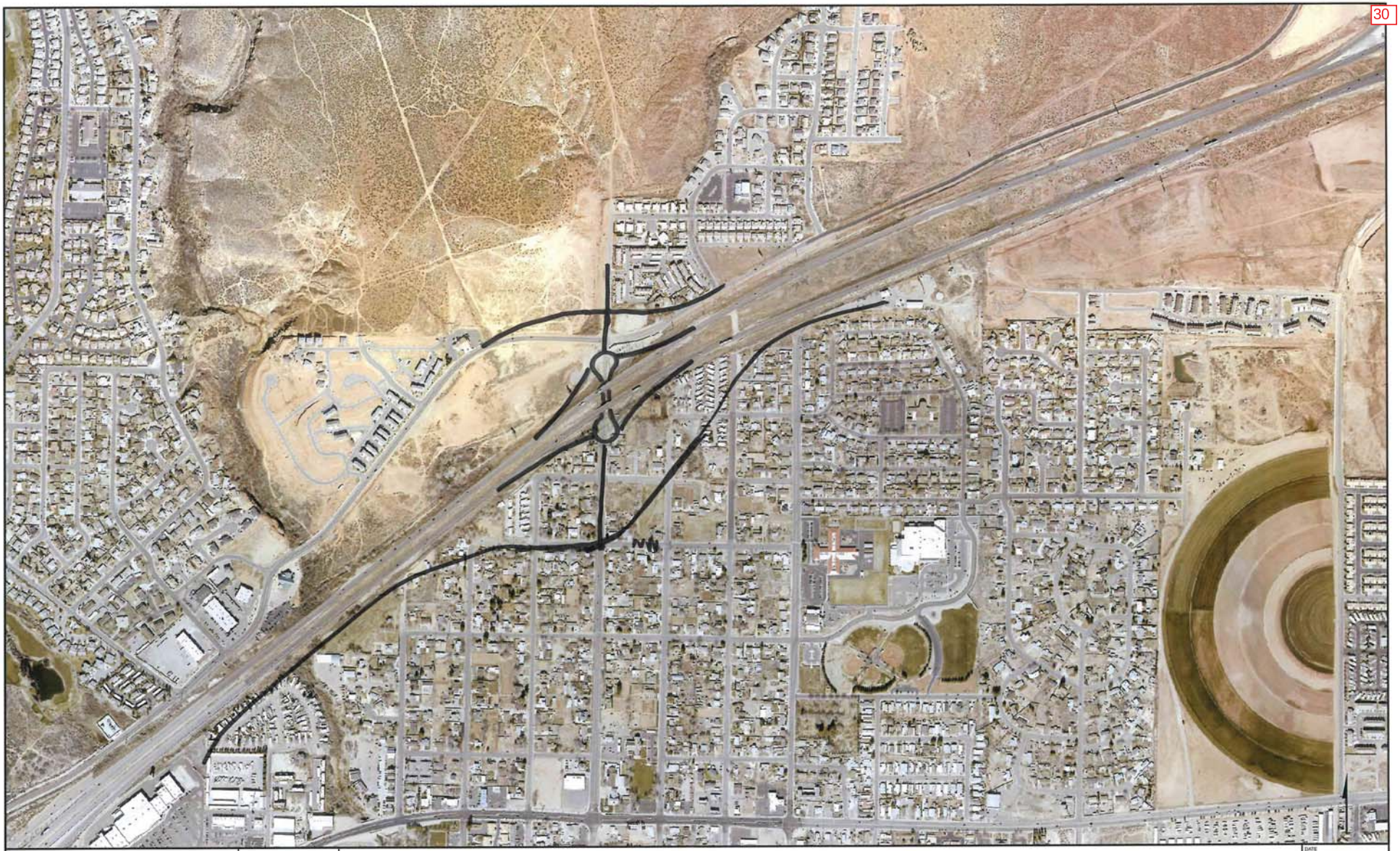
Exit 11 Feasibility Study

Option

DATE 3/31/2014

DRAWN

Figure 2



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Exit 11 Feasibility Study

Option

DATE 3/25/2014

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Figure XX

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Exit 11 Feasibility Study

Option

DATE 3/31/2014

DRAWN

Figure 2

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St. George, UT 84770
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Exit 11 Feasibility Study

Option

DATE 3/25/2014

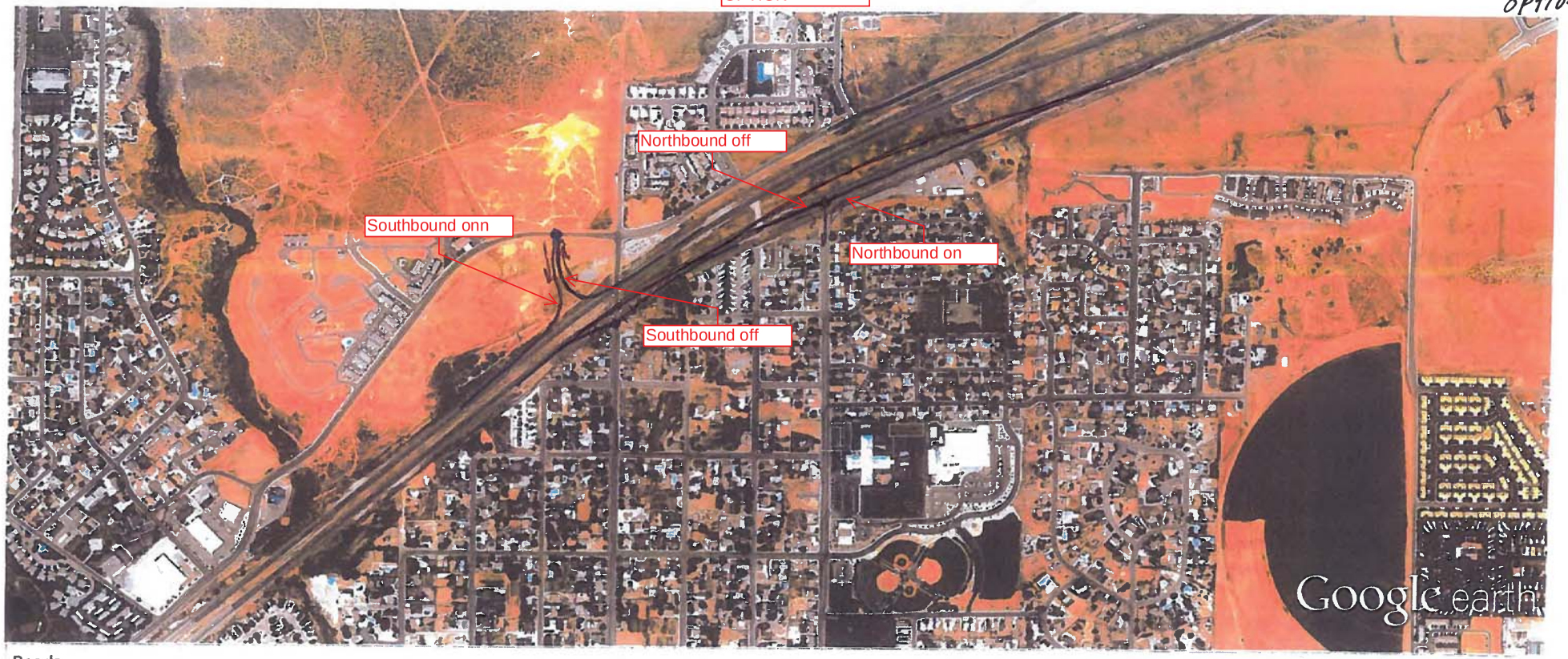
DRAWN

Figure XX

MPO option

Google earth

MILE POST 11 OPTION

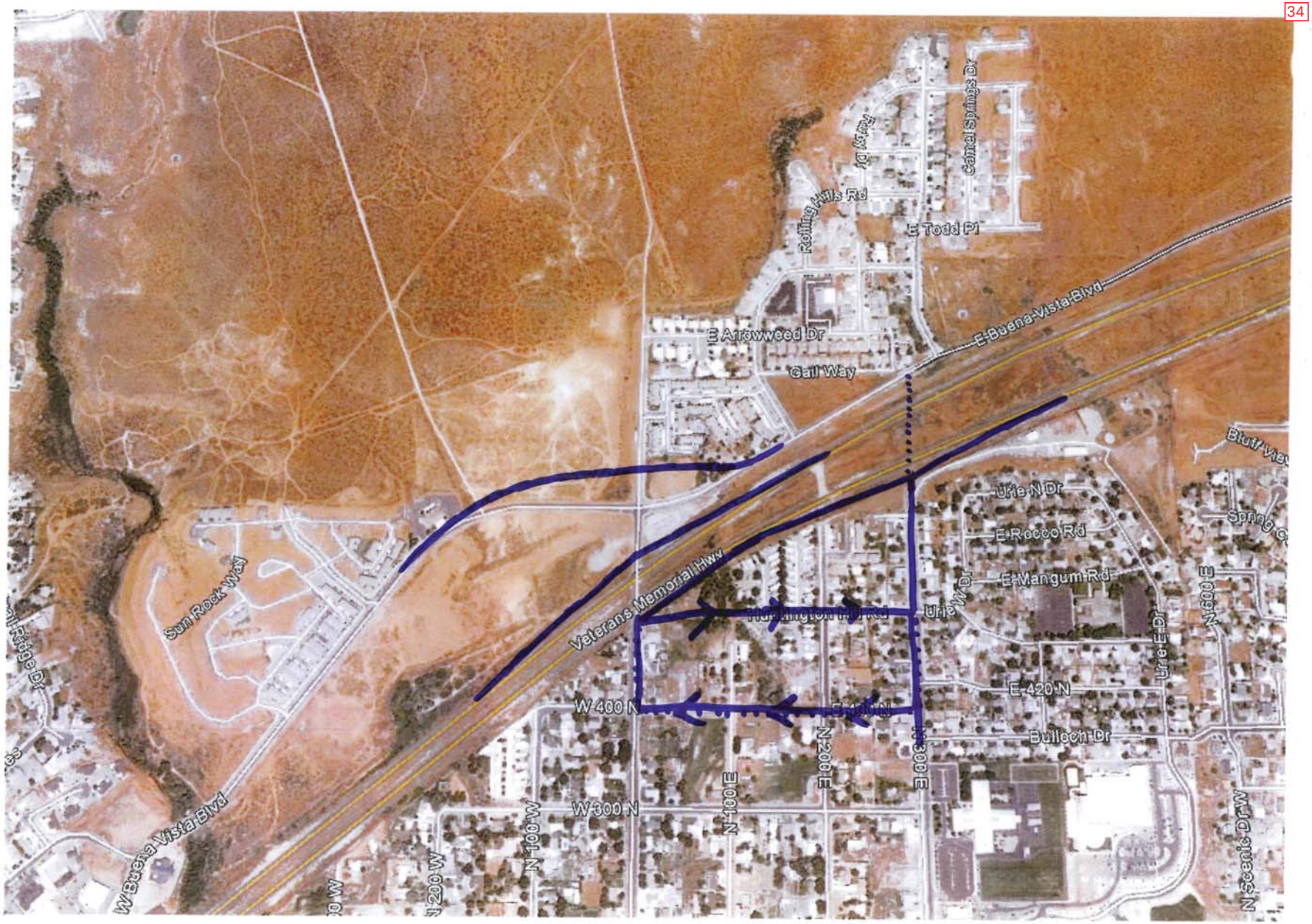


Roads

MAIN

300 E

SOUTH BOUND OFF and ON USE MAIN & FRONTAGE
NORTH BOUND OFF & ON USE 300 E
BECOMES SPLIT INTERCHANGE.
MITIGATE SPRINGS TO MOVE MAIN LINE @ 300 E
ALLOWS ON & OFF RAMPS TO REMAIN ON DOT ROW
WIDEN STRUCTURE @ MAIN FOR SOUTH BOUND DECEL & RAMP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Gail Way
E Buena Vista Blvd
Rolling Hills Rd
E Todd Pl
Canal Springs Dr
Veterans Memorial Hwy
Sun Rock Way
W Buena Vista Blvd
W 400 N
W 300 N
N 100 W
N 100 E
N 200 E
N 300 E
E 420 N
Bulloch Dr
Urie N Dr
E Rocco Rd
E Mangum Rd
Urie W Dr
Urie E Dr
E 600 N
N Seals Dr W

EXHIBIT 10
TELEGRAPH AND GREEN SPRINGS INTERSECTION STUDY
300 EAST INTERCHANGE - OPTION A

THIS OPTION UTILIZES THE CURRENT NORTH BOUND LANES ALIGNMENT

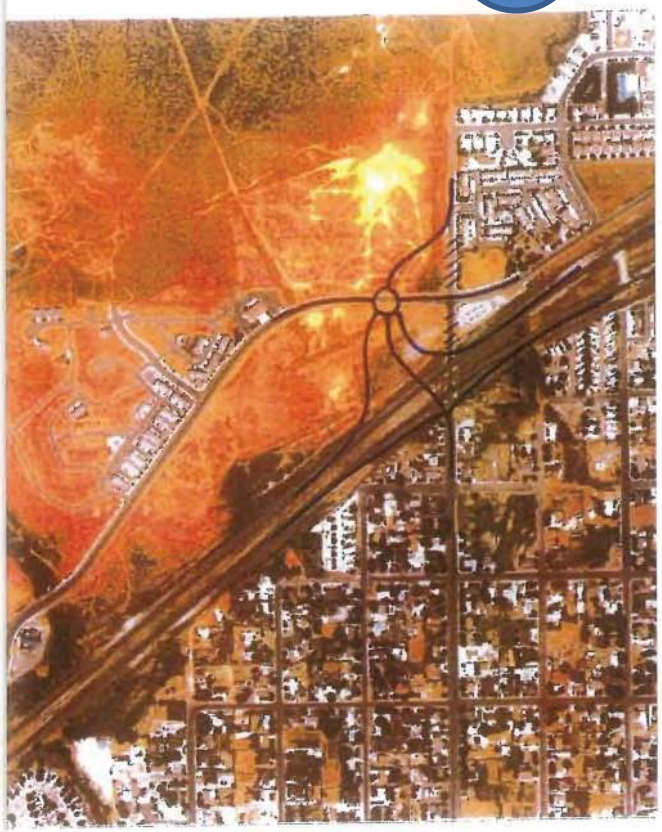
SUNRISE ENGINEERING
11 NORTH 300 WEST
WASHINGTON, UT 84780
TEL 435.652.8450 - FAX 435.652.8416


EXHIBIT 11
TELEGRAPH AND GREEN SPRINGS INTERSECTION STUDY
300 EAST INTERCHANGE - OPTION B
THIS OPTION UTILIZES THE CURRENT SOUTH BOUND LANES ALIGNMENT
NORTH
SCALE
0 100 200
HORIZ. 1" = 200'
BUENA VISTA BLVD.
GAIL WAY
EXISTING I-15 (SOUTHBOUND LANES)
RE-ALIGNED I-15 (NORTHBOUND LANES)
EXISTING I-15 (NORTHBOUND LANES)
1.07 MILES TO NEXT EXIT
1.36 MILES TO NEXT EXIT
MASTER PLANNED FRONTAGE ROAD
MAIN ST.
300 EAST ST.
SUNRISE ENGINEERING
11 NORTH 300 WEST
WASHINGTON, UT 84780
TEL 435.652.8450 - FAX 435.652.8416


EXHIBIT 12
TELEGRAPH AND GREEN SPRINGS INTERSECTION STUDY
300 EAST INTERCHANGE - OPTION C
THIS OPTION UTILIZES THE CURRENT NORTH BOUND AND SOUTH BOUND LANES ALIGNMENT.
LEFT SIDE ON AND OFF RAMPS ARE NOT RECOMMENDED
NORTH
SCALE
0 100 200
HORIZ 1" =200 '
BUENA VISTA BLVD.
GAIL WAY
EXISTING I-15 (SOUTHBOUND LANES)
1.07 MILES TO NEXT EXIT
EXISTING I-15 (NORTHBOUND LANES)
MASTER PLANNED FRONTAGE ROAD
1.30 MILES TO NEXT EXIT
MAIN ST.
300 EAST ST.
SUNRISE ENGINEERING
11 NORTH 300 WEST
WASHINGTON, UT 84780
TEL 435.652.8450 - FAX 435.652.8416

FIRST ROUND OF RANKED ALTERNATIVES

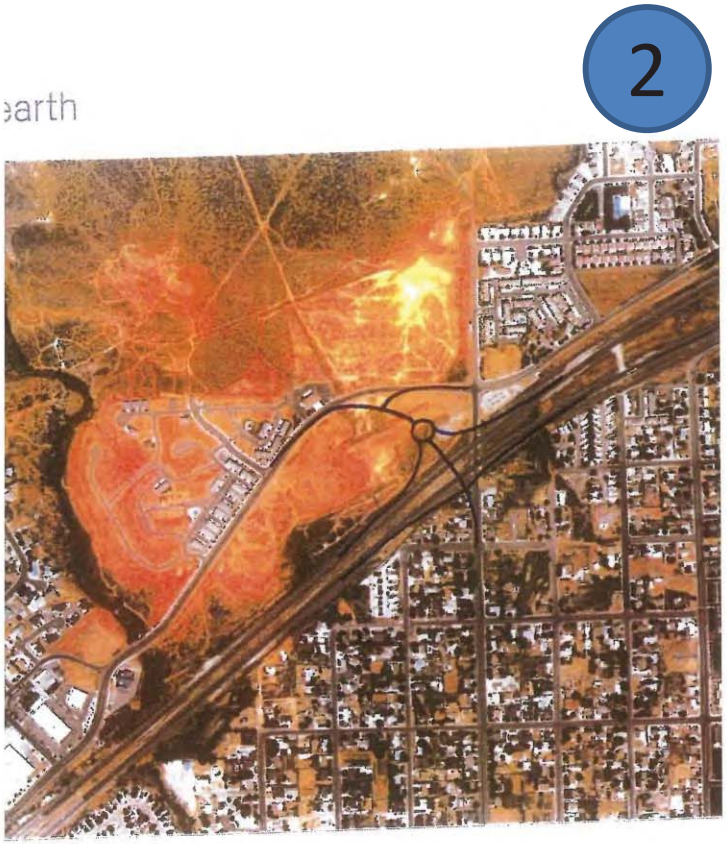
1



These two options are related, with the only difference being the insertion of Main Street to go under I-15 into the roundabout in Option 1.
The existing Main Street under I-15 would be kept in Option 2.

23

Diamond interchange in the northbound direction, and a roundabout ramp in the southbound direction.

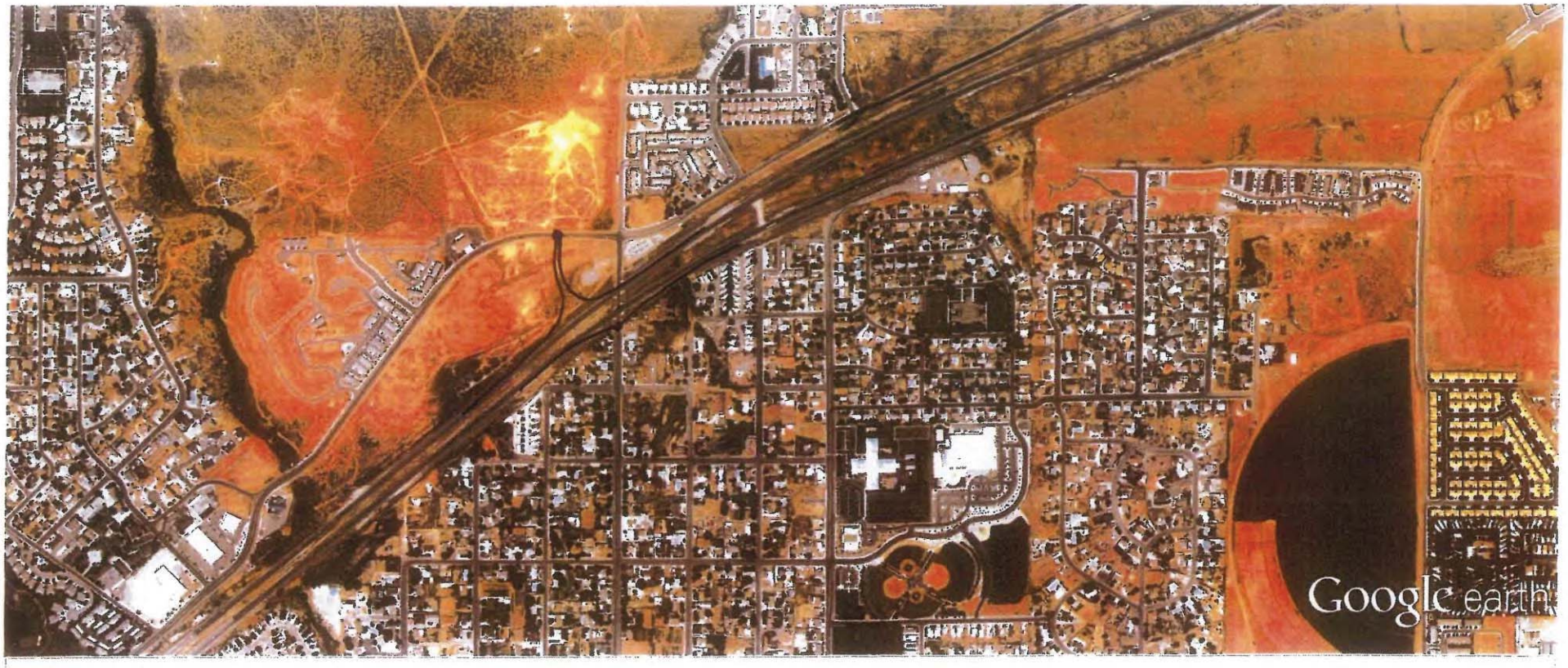


These two options are similar, with realigning Main Street and abandoning the existing Main Street under I-15. It would connect with I-15 using a diamond interchange. The major difference is how Buena Vista Blvd. connects with Main Street. The higher volume street should be the continuous route.

Google earth

Diamond interchange in the northbound direction, and a roundabout (or “T” intersection) for the southbound ramp.

3



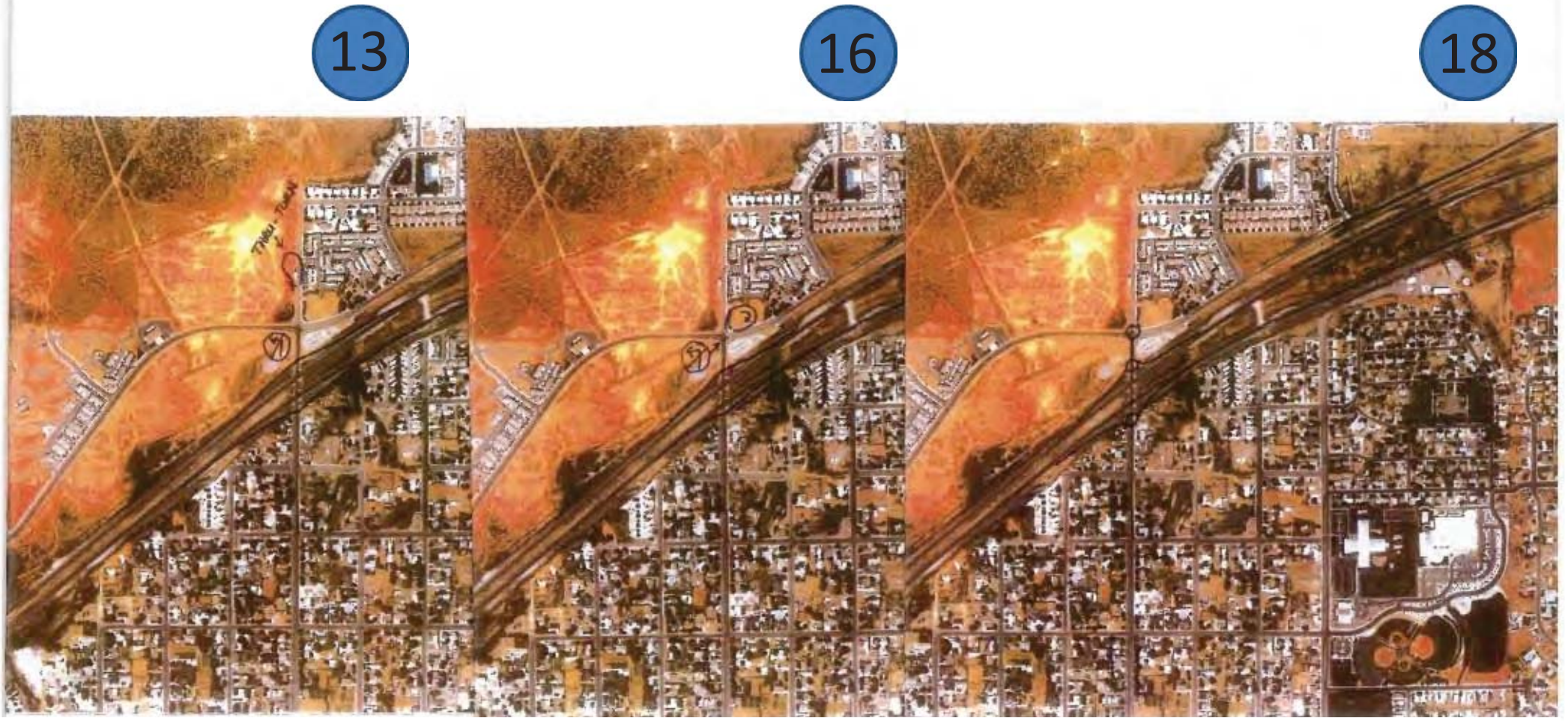
Roads

Google earth

Diamond interchange in the northbound direction at 300 East, and a roundabout ramp in the southbound direction.

9

The 300 East crossing could go over I-15 but would develop long inclined streets and possible sight distance issues. If 300 East went under I-15, a spring in the median would have to be dealt with and there would still be inclined streets that would impact adjacent accesses.

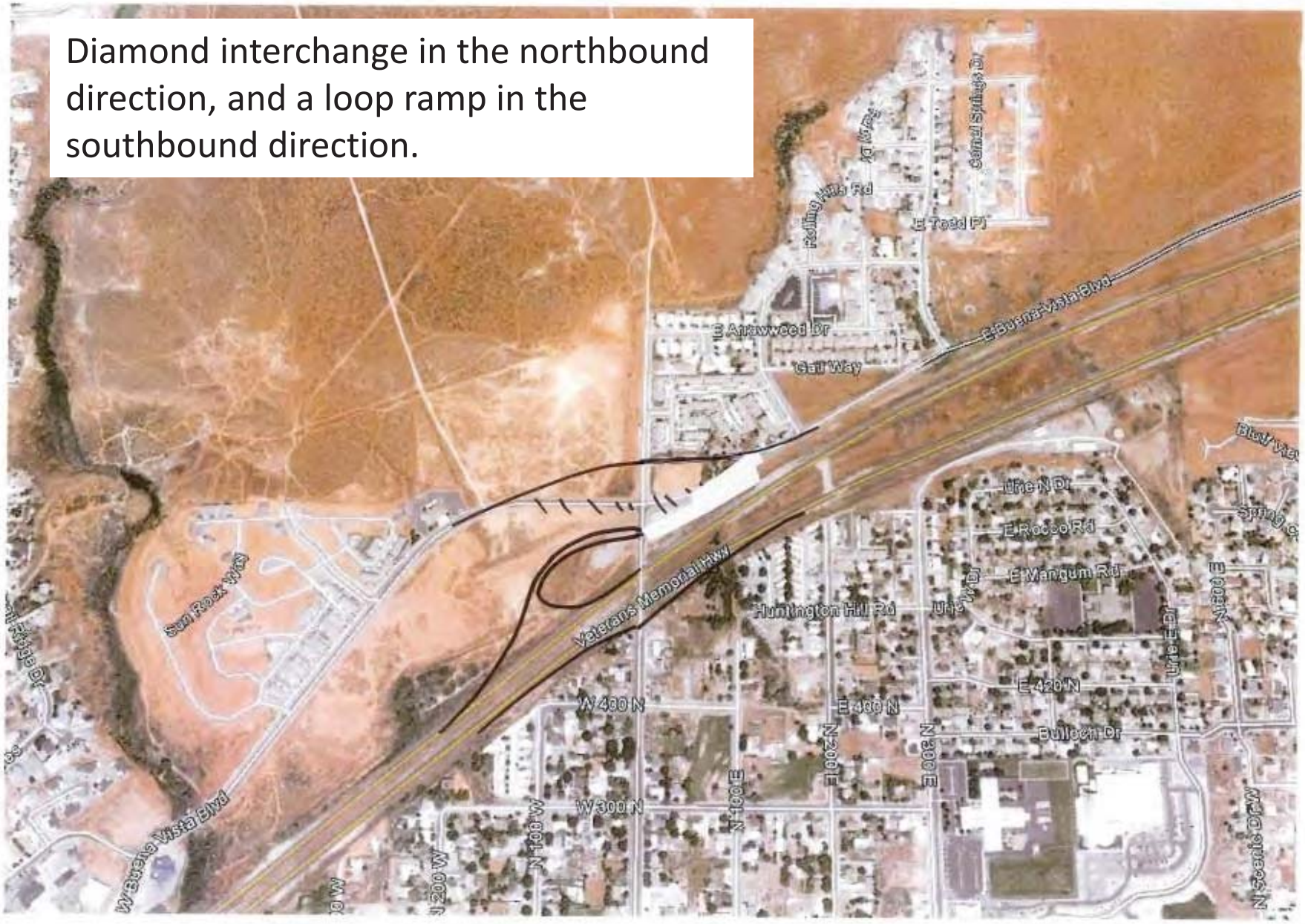


These 3 options show a typical diamond interchange configuration at Main Street. Each option lends a different method to help deal with capacity issues using thru-lefts, a right-turn loop, or roundabouts.

Diamond interchange in the northbound direction, and a roundabout ramp in the southbound direction.

The roundabout would have to be shifted to the southwest so it is entirely on City-owned property to avoid moving the substation and having negative impacts to the Henry Walker development.

Diamond interchange in the northbound direction, and a loop ramp in the southbound direction.



To maintain continuity with Buena Vista, the road is shifted to the north, as shown.

Both of these options share a roundabout interchange configuration, one in a large format and the other in dual teardrops, or “pinched” roundabout.

This solution could be configured with the south frontage road as shown, or not. Option 25 would have 4 culverts to accommodate a single-lane roundabout. Option 26 would keep the location of the existing Main Street I-15 undercrossing but it may impact the substation and large power pole location on the north side, depending on how it is situated.

This 300 East interchange is shown as a SPUI, but would still work as a diamond interchange. If the northbound lanes are shifted to the alignment shown, the former northbound lane location could be used for a new frontage road to connect Main Street to Milepost 13. The spring in the median would need to be dealt with.

Sunrise 11


HORROCKS
ENGINEERS