Section 2
Existing Conditions Assessment

SECTION 2 – EXISTING CONDITIONS ASSESSMENT

Existing conditions in the VVWRA Interceptor were assessed. The assessment included: collection and review of existing construction drawings; a detailed field survey of each manhole using both Global Positioning System (GPS) and electronic leveling technologies; and a visual condition assessment of each accessible manhole.

The condition assessment was conducted with the following objectives in mind:

1. To develop the horizontal and vertical locations of manholes and the sewers connected to the manholes for input to the Interceptor Model.
2. To verify the lateral connection information shown on the construction drawings for input to the Interceptor Model.
3. To provide information and assessments to supplement the Operations and Maintenance Plan under development by VVWRA for the SSMP mandated by the SWRCB.
4. To provide data that will be suitable for input to a GIS.

2.1 EXISTING DATA COLLECTION AND REVIEW

Existing data fell into three categories:

1. Existing design and as-built drawings of the VVWRA Interceptor.
2. Existing design and as-built drawings of member agency sewerage systems.
3. Sewerage master plans completed for VVWRA and its member agencies.

2.1.1 Design and As-Built Drawings Review

Drawings of the existing VVWRA Interceptor were reviewed to collect data points for the Interceptor Model and to ascertain any special conditions that may affect construction of parallel or replacement sewers. As-built drawings were used when available. The following information was researched:

1. Pipe diameter.
2. Pipe material.
3. Lateral locations.
4. Sewer depths for possible impact on flow monitor installation or the field electronic survey.
5. Unusual manhole construction features that could affect hydraulics.
6. Easement constraints that could impact parallel sewer construction.
7. Accessibility constraints that could impact the cost and/or schedule of parallel sewer construction.

The calibrated model is described in detail in Section 5 and reflects the drawings review work. The following highlights some of the information derived from the review of existing drawings:

1. The Interceptor begins at the southernmost point in the City of Hesperia. This section was constructed in 1980/1981 and is PVC. Sewer sizes in this portion were increased and decreased to take advantage of changing ground slopes; resulting in sudden enlargement or contraction at transition manholes. Two 90 degree bends were constructed at Bear Valley Road. The most upstream portion of this segment is beneath the pavement in "I" Avenue. North of Bear Valley Road the Interceptor was constructed in unpaved areas adjacent to the railroad tracks. The sewer was constructed deep in "I" Avenue, north of Lemon Street, with depths extending to 30 feet below finished surface. Easement width is 30 feet outside of the public right of way.

2. The Hesperia segment joins the Spring Valley Interceptor (SVI) in the Mojave Regional Park. Special design consideration for Construction will be required because of State park constraints. The SVI was the first constructed for VVWRA in 1973 using vitrified clay pipe (VCP). The SVI is adjacent to a railroad which could impact parallel sewer construction. Groundwater in the area is known to be high, and heavy rain floods land over and adjacent to the SVI.

3. The South Apple Valley Interceptor (SAVI) upstream end begins near the intersection of Highway 18 and Aztec Rd in the Town of Apple Valley. The pipeline is routed westerly along Outer Highway 18 and connects to Victorville Schedule V within the Mojave River. The SAVI connects just north of the Upper Narrows. Land south of the Upper Narrows was a large lake in ancient times. An earthquake caused the rock to split at the Upper Narrows, draining the lake to the Mojave River. Water erosion widened the split over the years. Previous construction shows the presence of large boulders north of the Upper Narrows. The SAVI was constructed in 1981 using PVC. The furthest downstream portion of the SAVI, between the connection to Schedule V and Manhole #3 is ductile iron pipe. A portion of the SAVI is beneath the pavement of Outer Highway 18. There are two 90 degree bends in the SAVI. Three pump stations were noted that discharge to the SAVI: Otoe, Nanticoke; and Riverside 2.

4. Downstream from the SAVI connection is the Victorville Interceptor (VI) which was constructed in 1976 to 1979 of VCP. The City of Victorville VSD-1 through VSD-6 laterals connect to this portion of the Interceptor. The upstream portions of the VI are in and adjacent to the Mojave River in unpaved areas. The VI crosses Highway 15 and is routed through private property owned by the Cemex Corporation. The VI then traverses the Lower Narrows. The original VCP section was washed out of the Lower Narrows and has been replaced with steel pipe. Downstream from the Lower Narrows, the VI is routed along the Mojave River to Shay Road to VSD-3 where the VI transitions to a double barrel sewer (36-inch and 42-inch) which are concrete pipes. The

remainder of the VI is routed down Shay Road (a public paved street) to the RWWRF. Easement width in the single barrel portion of the VI is 15 feet. Easement width in the double barrel portion is 15 feet for the Main Interceptor and an additional 10 feet for the Relief Sewer on the side away from the Main Interceptor.

5. The North Apple Valley Interceptor (NAVI) is the newest pipe in the VVWRA Interceptor collection system, built in 2002 and 2003. The NAVI originates from the High Desert Juvenile Detention and Assessment Center near Bell Mountain and extends south along Dale Evans Parkway to Stoddard Wells Road. From the Stoddard Wells Road and Dale Evans Parkway intersection the pipeline heads south and southwesterly across the 15 Freeway into the City of Victorville. The Interceptor continues southwest generally along Stoddard Wells Road to its outlet into the Victorville Schedule 4 Interceptor. The NAVI ranges from 18-inch to 24-inch diameter PVC. Easement width ranges from 15 to 25 feet.

2.1.2 City of Hesperia Data

The City of Hesperia contracted with Carollo Engineers to complete a master plan for the City's wastewater collection and conveyance systems. A final draft of the report was obtained, dated March 2007.

The City of Hesperia owns, operates and maintains approximately 60 miles of gravity sewer pipe, 882 manholes and one lift station with associated force main. The collection and conveyance systems currently discharge to the VVWRA Interceptor that is situated along the northeast boundary of the City. Major connections to the VVWRA Interceptor are located along I Street at the intersections of Hercules Street, Lemon Street and Bear Valley Road.

Sewage flow in the City originates from residential, commercial and industrial customers. The average flow in the City, metered in 2006, was 2.06 million gallons per day (mgd): 66% residential; 27% commercial; and 7% industrial. The master plan projected City flow to increase to 9.90 mgd in 2022 and 12.20 mgd in 2032.

The master plan identified a number of improvements to the City's collection and conveyance system in order to meet the projected increase in sewage flow:

1. Approximately 22.5 miles of new gravity sewer, ranging in size from 10 inches-diameter to 30 inches-diameter.

2. Three new lift stations: a 300 horsepower station to transmit raw sewage to a proposed Water Reclamation Plant 1 (WRP-1); a 400 horsepower station to transmit raw sewage to a proposed Water Reclamation Plant 2 (WRP-2); and a 100 horsepower station to transmit waste solids from WRP-2 to the existing VVWRA Interceptor.

3. Approximately five miles of new force mains: six inches-diameter to 20 inches-diameter.

4. Three water reclamation facilities: WRP-1 with an ultimate average flow capacity of 7.4 mgd; WRP-2 with an ultimate average capacity of 8.5 mgd; and Water Reclamation Plant 3 with an ultimate average capacity of 4.7 mgd.

Water reclamation plants were proposed to be constructed in phases to match flow increases within the City. Waste solids from WRP-1 and WRP-2 would be routed to the VVWRA Interceptor. WRP-3 proposed to treat waste solids on site.

There were three pieces of information in the Hesperia Sewage Master Plan that were critical to this Master Plan:

1. Flow monitoring was conducted in the City in April 2006. This monitoring facilitated allocation of current average flow to the load manholes in the Interceptor and formed the basis for estimation of the diurnal patterns of those flows.

2. The Hesperia Master Plan estimated the timing and location of future residential, commercial and industrial projects in the City. This information

was key to the estimation and proportional allocation of future flow at each load manhole in the VVWRA Interceptor Model.

3. The estimates of the timing of future water reclamation plants, their treatment capacity and plans for treating waste solids on site were factored into the scenario selections for the Hesperia and downstream VVWRA Interceptor trunk sewers.

2.1.3 Spring Valley Lake Data

Spring Valley Lake has approximately 10 miles of gravity sewers that are owned and maintained by the County of San Bernardino as County Service Area 64 (CSA-64). This collection systems discharges to the VVWRA Interceptor at the north boundary of CSA-64.

Spring Valley Lake is largely built out. An estimate of developable land was obtained from the County and used in the estimates for future flow incorporated into this Master Plan. This estimate showed approximately 460 lots remaining for residential development out of the original 3,900 available lots. The pace of recent development in this area has averaged approximately 80 lots per year. At an average flow of 250 gpd/unit this equates to an average annual flow increase of 20,000 gpd for the next 6 years to reach build out. This was used for the future flow projections to the Spring Valley Lake/CSA-64 Interceptor.

2.1.4 Town of Apple Valley Data

The Town of Apple Valley last updated its Sewer Master Plan in August, 1993. The document recommended improvements to four areas in the Town:

1. For the Desert Knolls Area, a water reclamation plant was recommended with utilization of the 2B Lift Station to boost sewage to the headworks of the reclamation plant. Water reuse was recommended for irrigation at Brewster Park and the Apple Valley Country Club.

2. For the West and Southwest Apple Valley Area, recommended improvements included construction of trunk sewer lines and a subregional water reclamation plant for the drainage area south of Bear Valley Road.

3. For the South Central Area, two trunk sewers, along Navajo Road and Central Road, were recommended. These trunk sewers would carry flow to the proposed subregional treatment plant, AV#1.

4. For the North Apple Valley Area, new trunk sewers were recommended to carry a portion of the sewer to the proposed subregional treatment plant AV#2. The remaining portion of this area included new trunk sewers to carry sewage to the proposed subregional treatment plant AV#2.

A major improvement was constructed in 2003 that changed the 1993 plan for North Apple Valley. The VVWRA North Apple Valley Interceptor, built in 2003, will now serve development in this area.

One key piece of information from the Apple Valley Master Plan was of particular interest for this Master Plan: The Apple Valley Master Plan recommended a subregional reclamation plant in Brewster Park with utilization of the Otoe Lift Station to deliver sewage to the reclamation plant. The force main from Otoe was purposely oversized to ultimately deliver recycled water from the treatment facility to the Apple Valley Country Club. This capital improvement scenario was considered in Section 4 of this Master Plan.

In addition to review of the 1992 Apple Valley Master Plan, an assessment of the Riverside Pump Station 2 was conducted. The Riverside 2 pump station lifts sewage from a residential section of South Apple Valley (SAV). The lift station force main discharges into the VVWRA South Apple Valley Interceptor at SAV Manhole #4, near the downstream end of the Interceptor behind the Lewis Learning Center. Figure 2-1 shows the force main lateral connection to the SAV Interceptor. The assessment of the pump station provided critical information for the model calibration process described in this report in Section 4. The pump station assessment included:

1. A physical inspection of the station.
2. A briefing from Town Staff on station control.
3. A measurement of sewer flow depth versus pumps in operation.
4. Review of the pump curves.

Figure 2-1
Apple Valley Riverside Pump Station Force Main Connection

2.1.5 City of Victorville Data

The City of Victorville contracted with Earth Tech to provide a sewage master plan in 2005. This master plan incorporated existing flows and estimated future flow for the entire City of Victorville sewer service area. A final draft of this report was obtained from the City in March of 2008.

Flow growth was estimated within planning areas of the City. The future flow estimate in the years 2014 and 2030 was 13.9 and 25.7 million gallons per day (MGD), respectively. This information was used in this master plan to proportion future flow growth projected for the City of Victorville connections to the VVWRA interceptor described in Section 4 of this report.

The Victorville sewer master plan recommended significant upgrades to the Victorville collection system. The 2014 and 2030 planning horizons were used to phase the upgrades into service. For the 2014 planning horizon a total of 252,000 lineal feet of new sewer pipe is proposed, and an additional 157,000 lineal feet of upsized lines. For the 2030 planning horizon an additional 49,000 lineal feet of existing sewer pipe is scheduled for upsizing. Three WRP's within the City were also identified.

2.1.6 VVWRA RWWRF Review

Flow records from the VVWRA RWWRF Influent Flow Meter were reviewed. This meter data was valuable from two perspectives:

1. VVWRA recently installed a new magnetic flow meter which can potentially provide the highest level of accuracy (plus or minus two percent versus the flow metering in the field manholes, which is typically plus or minus 10%) of total flow in the service area and the diurnal pattern of that flow at the end of the sewer. The total flow recorded at the plant was used to adjust flow monitoring data to develop accurate existing flows in the Interceptor reaches as there is a significantly higher amount of error associated with the flow meters installed in the manholes. This was useful for the model calibration and capacity analysis described in Sections 3 and 4.

2. Storms in the high desert are infrequent. The influent flow meter, along with the influent flow equalization basin were valuable for assessing overall wet weather impacts due to Inflow and Infiltration (I/I) in the VVWRA system. Wet weather flows were derived for this Master Plan based on this data as described in Sections 3 and 4.

2.2 FIELD SURVEY

A comprehensive field survey was conducted for every manhole on the main VVWRA Interceptors. The information from this survey was used for two primary purposes in this master plan:

1. To provide the horizontal manhole location data for input to the Interceptor Model and GIS database.
2. To provide as-built sewer invert data for the Interceptor Model.

The procedure for the field survey of manholes was completed in three steps:

1. Locate the top center of the manhole cover horizontal coordinates with a Global Positioning System (GPS) device.
2. Measure from the top of manhole down to the incoming and outgoing pipe inverts at each manhole.
3. Use electronic leveling off of existing benchmarks to attain a high accuracy elevation at top of manhole.

2.2.1 Horizontal Positioning of Manholes

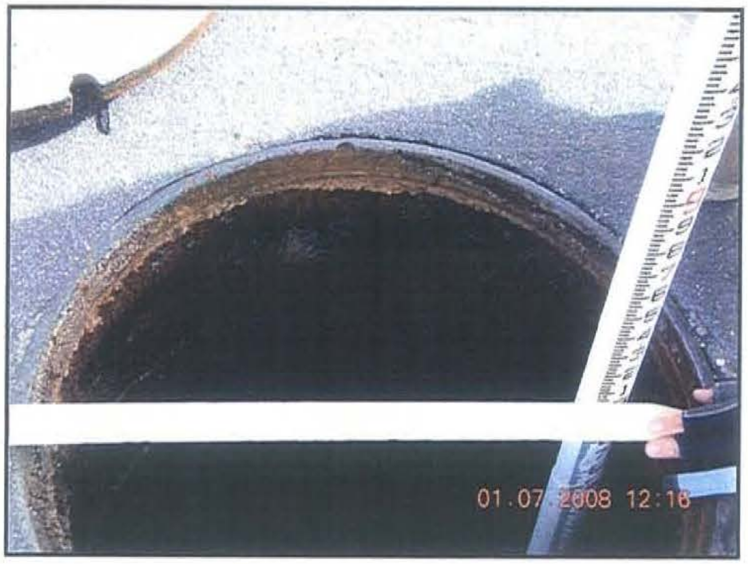
For each of the VVWRA Interceptors in focus for this master plan a GPS receiver was used for locating the horizontal position of the center of the lid at each manhole. The level of accuracy for the horizontal position is ± 2-inches. VVWRA staff assisted the field surveyors by locating and marking the manholes to ensure the entire reaches of pipe were surveyed in and labeled correctly. The data from the GPS survey was input into the hydraulic model, which utilizes a GIS base file, to create an accurate database of the system. The horizontal positioning data, expressed in State Plane Coordinates can also be used for the GIS database in compliance with the requirements of the SSMP. A vertical elevation of the lid is also recorded through the GPS unit, however, this value is used for reference only as the accuracy level is lower than conventional survey methods. Figure 2-2 depicts the typical GPS survey equipment set-up.

Figure 2-2
GPS Survey

2.2.2 Field Measure of Sewer Inverts

At each manhole in the VVWRA Interceptor, a vertical distance was measured downward from manhole top to the available sewers using survey rod as shown in Figure 2-3. Because of the conical section installed in most manholes, either the upstream or downstream sewer was not available for direct measurement downwards. To approximate the invert of the unavailable sewer, the manhole center was measured, and the unavailable invert was extrapolated from the two measurements for inclusion in the Hydraulic model and GIS database.

Figure 2-3
Sewer Pipe Invert Measurement



Care was taken that the bottom of the measuring device was at invert elevation and not on a piece of debris. It is estimated that this method of measurement produces an accuracy of plus or minus 1/4-inch per measurement. Taking the maximum range of this inaccuracy over a typical sewer length between manholes of 350 feet yields a slope differential of 0.04 feet, or an inaccuracy of approximately 2.2% for a typical slope of 1/2%.

2.2.3 Electronic Leveling

To attain a higher level of accuracy on the vertical elevation of the manhole lid, when compared to the GPS horizontal position location method, an electronic level was used. This method utilizes existing survey benchmarks as a basis of vertical elevation and an electronic leveling device to determine the manhole rim elevation. The electronic leveling unit eliminated the human error element associated with traditional manual leveling methods. An example of the electronic leveling technique and equipment is shown below in Figure 2-4.

Figure 2-4
Electronic Leveling

The field survey data is included for each manhole is included in Appendix A.

2.3 CONDITION ASSESSMENT

A condition assessment of all manholes was conducted in conjunction with the field survey. The condition assessment was conducted with several goals in mind:

1. Structural Assessment – To determine if manhole cleaning, repair or replacement will be necessary due to such factors as corrosion, lining/coating deterioration and subsidence.

2. Physical Verification – To confirm the accuracy of the design drawings regarding manhole location, major inlet connections, pipe diameters, pipe bends and pipe materials.

3. Flow Characteristics – To verify flow conditions within the manhole: depth of flow at time of inspection: manhole hydraulic characteristics; pipe constrictions or blockage; evidence of surcharge events; and presence of fats, oils and grease.

The data gathered was compiled in a field assessment form. Figure 2-5 shows an example of the document used. A completed condition assessment form for each of the manholes that were accessible is included in Condition Assessments Volumes A through E. The Condition Assessment Forms document the following:

1. Manhole location with supporting photos
2. Time and date of inspection
3. Horizontal and vertical survey data
4. Historical data
5. Physical dimensions
6. Presence of lateral connections
7. Representative manhole photos

FIGURE 2-5

VVWRA INTERCEPTOR SEWER MASTER PLAN
MANHOLE CONDITION ASSESSMENT FORM

FIELD ASSESSMENT DATA

VVWRA MH #	Time	Member Agency	Date	Inspected By
86	12:10 PM	Hesperia	1/7/2008	JW

Location

Between Hercules St. and Linden St. along I Avenue. Situated on West side of I Avenue, in dirt shoulder, just off the roadway.

Survey Data

Horizontal Location	Rim Elevation (ft)	Invert Elevation In (ft)	Invert Elevation Out (ft)
N 1979955.1480 E 6778598.6265	3091.78	3081.83	3081.61

Location:

Historical Data

Date of Construction	Date Last Cleaned	Date Last Videoed	Drawing Reference	Operational History
1981/1982			H-22	

FIGURE 2-5

VVWRA INTERCEPTOR SEWER MASTER PLAN
MANHOLE CONDITION ASSESSMENT FORM

Physical Data

MeasuredManhole Depth (ft)	Measured Water Level, (in)	Pipe Diameter In (in)	Pipe Diameter Out (in)	Pipe Material (In/Out)
9.95' - In 10.06' -CL	6"±	15"	12"	PVC

MH Cover Diameter (in)	No of Holes in Cover	Locked MH	Ladder Rungs	Condition of Cover
25"	1	Y (Allen 5/16")	Y	Fair, Some Rust

MH Diameter/Material	Side Laterals	Evidence of Surcharge	Height of Surcharge (ft)	Description of Surcharge
4' / Concrete	N	N	NA	NA

MH Coating	Existence of Debris	Existence of Fats, Oil, Grease	Special Flow Characteristics
N	N	N	N

Condition of Manhole		
Manhole in Excellent condition throughout, Minor corrosion at grade rings.		
Manhole Structure Damage Level Rating	1	See Section 2 of Sewer Master Plan for details on determination of damage level rating

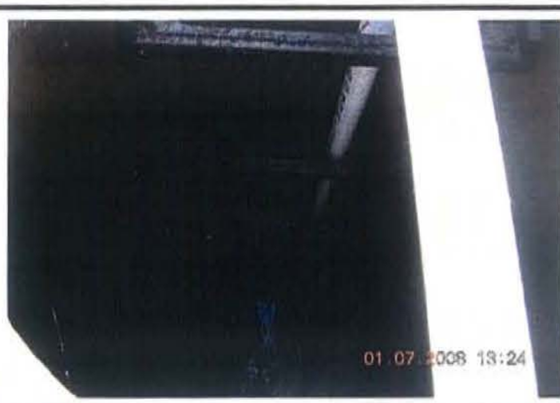
Rim:

Pictures File Path/Name

h:pdata\10105998\Images\Photography\Hesperia\MH 86

VVWRA INTERCEPTOR SEWER MASTER PLAN

MANHOLE CONDITION ASSESSMENT FORM



2.3.1 Structural Assessment

A visual rating system, the VANDA method, was used to assess the physical condition of manholes. This system was developed by V&A Engineering. The system uses a four-tier damage assessment for concrete structures as shown in Table 2-1 below:

Table 2-1
VANDA© Corrosion Damage Assessment Description

Damage Level Rating	1	2	3	4
Overall	Little or no damage	Observable damage to concrete mortar	Significant loss of concrete mortar	Rebar severely corroded; significant damage to structure
Hardness	No loss of mortar hardness	Some loss of mortar hardness	Complete loss of mortar hardness	Complete loss of mortar hardness
Smoothness	Surface smooth	Small-diameter aggregate exposed	Larger-diameter aggregate exposed	Larger-diameter aggregate exposed
Cracking	None	Thumbnail-sized cracks of minimal frequency	1/4" – 1/2" cracks, moderate frequency	Numerous cracks of 1/2" and greater
Spalling	None	Shallow, of minimal frequency	Deep spalling of moderate frequency	Deep spalling of high frequency
Reinforced Steel	No exposure or damage	Possible exposure, but no visible damage or corrosion	Exposed, damaged and corroded, but repairable	Corroded or consumed; structural integrity diminished

Each manhole structure was assigned a damage level rating which was recorded on the field condition assessment form based on the criteria above. A general description is included of the observations in the field.

Manhole accessories were similarly assessed for damage and, if appropriate, recommended for repair or replacement. This included the manhole frame and covers, cover bolts and locking mechanisms, interior coatings (where applicable) and ladder rungs.

Based on the field assessment, recommendations for rehabilitation or replacement of manholes were defined utilizing a priority ranking as follows:

- High Priority – Improvements are recommended to occur as soon as possible as a there is a significant liability risk or potential for significant negative impacts to the Interceptor system if delayed.
- Medium Priority – Improvements are needed and should be completed within 2 years, but pose no risk of significant legal liability to the agency or significant potential impacts to the Interceptor system if delayed.
- Low priority – Improvements are recommended, but may be delayed with low potential for negative consequences to the agency. Improvements are recommended to occur within the next 5 years.

2.3.2 Physical Verification of Interceptor Facilities

In support of the hydraulic modeling and GIS related tasks associated with this master plan, physical verification of existing conditions was recorded during the manhole assessment to confirm the accuracy of the design drawings. Where discrepancies existed, the databases were updated with the field verified information.

The following information was collected utilizing a standard measuring tape and/or the survey rod:

1. Pipe Diameter in and out of the manhole
2. Manhole structure diameter
3. Manhole lid diameter
4. Manhole depth

Pipe materials were verified based on visual inspection. Pipe bends were verified based on both visual inspection and a calculation based on the angles generated by the horizontal GPS survey between manholes.

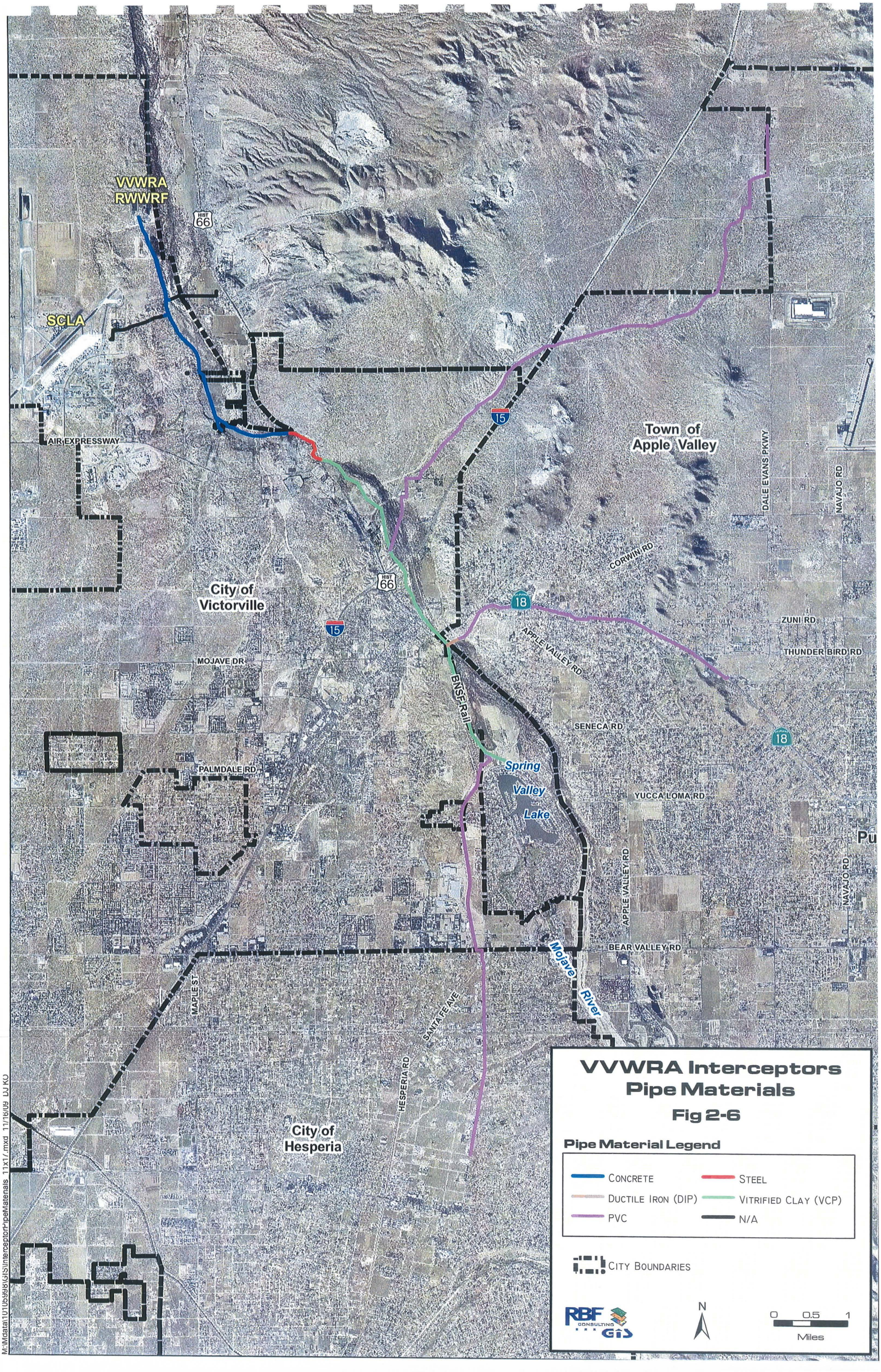
A summary of the pipe materials documented for each Interceptor Reach is shown on Figure 2-6.

2.3.3 Identification of Flow Characteristics

Flow characteristics were inspected at each manhole as a part of the condition assessment. The depth of flow at the time of inspection was recorded utilizing the survey rod for measurement. This depth measurement is a useful tool as a rough check on calibration of the hydraulic model, as a field verified water depth could be compared to the model predictions. Any unusual flow characteristic, such as high turbulence, was recorded on the data sheet.

Each manhole was checked for evidence of a surcharge event by visual inspection. Surcharge was assumed where debris was clearly identified on the manhole benches, ladder rungs or manhole walls. A description of the debris, an approximate height of surcharge event and representative photos were recorded on the assessment form.

Each manhole was visually inspected for the presence of fats, oils and grease. The presence of these substances, where encountered, was recorded on the assessment form.



VVWRA RWWRF
SCLA
66
15
AIR EXPRESSWAY
Town of Apple Valley
DALE EVANS PKWY
NAVAJO RD
CORWIN RD
City of Victorville
18
ZUNI RD
THUNDER BIRD RD
APPLE VALLEY RD
MOJAVE DR
BNSF Rail
SENECA RD
PALMDALE RD
Spring Valley Lake
YUCCA LOMA RD
APPLE VALLEY RD
NAVAJO RD
BEAR VALLEY RD
Mojave River
MAPLE ST
SANTA FE AVE
HESPERIA RD
City of Hesperia
VVWRA Interceptors Pipe Materials
Fig 2-6
Pipe Material Legend
CONCRETE
STEEL
DUCTILE IRON (DIP)
VITRIFIED CLAY (VCP)
PVC
N/A
CITY BOUNDARIES
RBF CONSULTING GIS
N
0 0.5 1
Miles