
Appendix K

Conceptual Drainage Report

A full copy of the complete Conceptual Drainage Report,
including all the appendices is available for review at the City of Dixon

CONCEPTUAL DRAINAGE REPORT

FOR

DIXON DOWNS
(PART OF NQSP)

CITY OF DIXON, CA

September 7, 2004
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Job No. 000147



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EXECUTIVE SUMMARY

This drainage study has been prepared to identify the drainage impacts with the proposed Dixon Downs Development and recommend mitigation measures for the project. The XP-SWMM model from the Dixon Watershed Management plan forms basis for hydrologic modeling conducted under this report. Following is the summary of modeling and mitigations required with the project:

Existing Drainage Condition:

The updated existing condition model for the project has been reviewed and accepted by West Yost & Associates for this project.

- At I-80, the 100-year storm event causes overtopping with a ponding elevation of 66.2 ft on the upstream. For the 10-year storm event the ponding elevation is 65.1 feet, no overtopping occurs.
- The West property line for the site forms upstream hydrologic boundary. The project site receives offsite flows across west property line via existing 42" SID irrigation pipe (Solano Irrigation District – irrigation pipe that serves as drain pipe in winter) and overland sheet flow. For the 100-year storm event the ponding elevation at the low-lying area located on the property west of the project is 62.2 ft, the peak flows into the project are 198.6 cfs. For the 10-year storm event the ponding elevation at the low-lying area located on the property west of the project is 60.6 ft, the peak flows into the project are 44.6 cfs.
- 263 acres project site drains easterly to Pedrick Road generating a peak flow of 156.2cfs for 100-year and 60.4 cfs for the 10-year storm event.
- The east property line (Pedrick Road) forms the downstream hydrologic boundary for the Project. The drainage from the project flows east across Pedrick Road through existing CMP culverts and overland. For the 100-year storm event the ponding elevation at the low-lying area located on the project site is 58.8 ft, the peak outflows from the project are 209.2 cfs. For the 10-year storm event the ponding elevation at the low-lying area located on the project site is 57.6 ft, the peak outflows from the project are 127.4 cfs, Pedrick Road gets overtopped for 10year storm event too.
- The drainage area south of the project site (Node NEQ on the Drainage shed maps) normally drains across Vaughn Road via existing 24" CMP culverts. It overland releases northerly in the roadside ditch located along eastside of Pedrick Road, when the inflow exceeds the culvert capacity.
- The existing flows from the project drain to Union Pacific Railroad (UPRR) and are joined by offsite flows from Basin G1, causing widespread ponding in the farming area located between Pedrick Road and UPRR. The flows ultimately drain to Tremont 3 drainage system in non-maintained existing drainage ditches. Tremont 3 is the receiving drainage system constructed for agriculture drainage (With undefined level of flood protection) to receive flows at rate of 0.02cfs per acre from its defined service area, maintained by Dixon resources Conservation District (DRCD).

Post-Development Project Drainage:

- The post development project will receive the existing flows at the upstream hydrologic project boundary in the proposed 2-60" Drainpipes under future Professional Drive. The piped inflow will be reduced by an orifice to an equivalent of 42" existing drain. The overland inflow will be allowed at the existing ground elevations.
- The project barn area located on southwest of the site will drain to channel and be combined with offsite flows. The stormwater quality flow from the horse walk-paths of barn area will be intercepted for 25year-24 hour storm event and drained to the sanitary sewer system (See Storm Water Quality Report by HDR, INC.). The paved area and roof area of the barns will be provided with a piped drainage system designed to convey 25-year storm to the detention channel. The combined stormwater flows will be conveyed to Pedrick Road in twin 66" drainpipes. The northern part of the project will be drained through an onsite detention pond.
- The project proposes a private detention facility in the racetrack to mitigate the post-development peak flows from the project. The detention pond will utilize the depressed middle area of the track with 1:10 slopes and approximate 4 feet of depth with pond bottom at 57.5 feet (NGVD). The northern part of the project will be draining in a piped drainage system to infield track detention pond. The bottom of the track infield will have a piped drainage system.
- The combined flows from the twin 66" drains will be conveyed to Pedrick Road diversion structure. The diversion structure will have two outlet drain pipes (48" and 27") discharging to the existing ditch. The diversion structure will have one 48" drain and one 18" drain connected to the infield detention pond piped drainage system. As the outfall pipes (1-27" and 1-48") are smaller than the inflow pipes (2-66"), the stormwater will back-up into the track-detention pond via 48" drain and 18" drain and bubble-up from the drain inlets at the bottom of the detention pond. The 48" drain will have flap gate to allow inflow into the detention pond, but no outflow. For outflow from the infield detention pond, an 18" drain is proposed that will allow free flow into and out of the detention pond.
- The average detention pond bottom has been established at 57.00 (NGVD). The storage of storm water will cause 100-year ponding elevation of 60.0 feet, and 10-year ponding elevation of 57.9 feet. The ponding duration will be approximately 10 days for a 100-year 4day storm and 3.5 days for 10-year 24-hour storm.
- The project will discharge across the downstream hydrologic boundary, the peak flows of 151.1 cfs for the 100-year and 63.3 cfs for the 10-year storm event. The post development flows will be significantly lower than existing peak flows crossing Pedrick Road (220.3 cfs for 100-year and 205.6 for the 10-year storm event).
- The post-development drainage ponding elevations in the farming area located between Pedrick Road and UPRR will be 58.87 feet for 100 year and 57.62 feet for 10-year storm events versus existing condition ponding elevation of 58.86 for 100-year and 57.62 feet for the 10-year storm event.

- To avoid any inadvertent flow from the project to the existing low-lying area at NE corner of Vaughn Road and Pedrick Road, the project will install berm along the southern boundary and a 24" pipe with a flap gate to allow northerly overland release from this area.

NEQ- Outfall and Overall Drainage:

The analysis for the overall Northeast Quadrant Drainage system is not a part of proposed drainage improvements for Dixon Downs. It has been performed to study the performance of isolated multiple detention ponds and model the preferred outfall option to route the drainage from NEQ to Tremont 3 system.

- An open channel outfall from the existing condition outfall across Pedrick Road straight east to Tremont 3 will require land acquisition and mitigation for wetlands. It may also amount to loosing/ regularizing existing natural storage in the farming area between Pedrick Road and UPRR. No hydrologic modeling has been performed for this outfall option.
- A piped drainage system going south along Pedrick Road and east along Vaughn Road has been identified as a preferred option. The drainage system will be sized to divert 10-year storm event to Tremont 3 (To meet the City of Dixon Engineering Design Standards). The excess flows beyond the 10-year storm event will be allowed to spill onto the existing receiving facility; the non-maintained drainage swale. This will significantly reduce the frequent flooding that currently occurs in the farming area located between Pedrick and UPRR.

Northeast Quadrant Outfall and Regional Drainage Issues :

The existing Tremont 3 and downstream drainage systems have been known to have widespread flooding problems as summarized in the Dixon Storm Drainage Report and Dixon Watershed Management Plan. The City of Dixon has adopted Joint Powers Agreement on September 28, 2004 per resolution No. 04-197 outlining the resolution to the outfall issues from Northeast Quadrant and required improvements to the downstream regional drainage systems. The regional drainage issues are beyond the scope of this report, however the project shall participate in the downstream drainage solutions based on the fair share for costs and the benefits received by the project.

Stormwater Quality Management:

The post-developed drainage system for the project will include treatment control best management practices (BMP's) for runoff originating from the commercial and industrial (The service area located in the south east part of the project) development. The stormwater quality runoff (25year-24hour) from the Stable Area that comes in contact with animal waste Stable Area will be intercepted stored in underground pipes and discharged into the sanitary sewer system (See Stormwater Quality Management Plan by HDR Inc.).

The storm water quality management plan included in appendix D shows the Vegetative Swale BMP's for the commercial and service area of the project. These BMP's are based on the preliminary pre-design information only. The final BMP's for

the project will include one or a combination of multiple BMP's compliant to the California Stormwater Quality Association (CASQA) BMP handbook for New-development and Re-development.

I. INTRODUCTION:

The proposed development "Dixon Downs" is a 260-acre mixed-use development. The project site is located west of Pedrick Road and North of Vaughn Road in the Northeast Quadrant (NEQ) of the City of Dixon. This drainage report will identify the drainage improvements to mitigate the post development project drainage impacts.

Dixon Downs is located within Northeast Quadrant (NEQ) specific plan area. The NEQ has been studied as a part of Basin D in the City of Dixon Storm Drain Report (March 1999) and Dixon Watershed Management Plan – (DWMP) (August 24, 2001). The latest study, DWMP has studied NEQ as Eastside Drainage Project for outfall alternatives. The report recommends that for NEQ development 'either run-off should be detained to existing rates or lower or the downstream conveyance must be constructed to convey the increased flows from NEQ and reduce the downstream flooding'. The study has estimated the existing flows 30cfs (From a 5-year Storm) up to 100cfs (From a 100-year Storm). The DWMP has recommended an outfall option allowing 135cfs discharge from NEQ with improved downstream conveyance.

1. Elevation Datum's:

There are two different elevation datum's are in use in and around the city of Dixon. These are National Geodetic Vertical Datum of 1929 (NGVD1929) and North American Vertical Datum 1988 (NAVD1988). NAVD1988 is higher than NGVD1929 by 2.4 to 2.5-feet. This drainage report and all Morton and Pitolo plans and topographic surveys are produced using the NGVD datum, for the purpose of this report *NAVD 1988* is assumed as *NGVD 1929+2.5* feet.

II SCOPE:

1. To study the existing drainage conditions.
2. To study the drainage mitigation measures for the project development.
3. To study the overall developed drainage system for the NEQ and outfall options.
4. To study the treatment control BMP's for stormwater quality management for the drainage originating from the impervious area of the project.

III Hydrologic / Hydraulic Analysis:

The XP-SWMM (Expert Storm Water Management Model) computer program has been used for the hydrologic and hydraulic analysis. The program has a capability to model the complex system of inter-connected multiple ponding areas with numerous outfalls. West Yost and Associates had prepared Dixon Watershed Management Plan for the regional drainage system for Solano County Water Agency based on the same computer program. A trimmed copy of the model representing the Tremont 3 drainage system was received from West Yost and Associates forms the base model for this project. For assumptions and the information on model development see Appendix E - Reference from Dixon Watershed Management Plan.

IV EXISTING CONDITION DRAINAGE:

The existing drainage scenario has been discussed in detail in the Dixon Storm Drain Report, March 1999 (DSDR). DSDR estimates 2700 acres of agriculture land drains across I-80 into NEQ through Two 36" culverts that get transitioned to 8'x4' culvert, then to 4'x3' box culvert, then to a single 36" culvert, lastly to twin 24" RCP culverts; and twin 29"x18" CMP culverts located approximately 700 feet northeast of SR-113 and I-80 overpass. A low point on the I-80 is also located at the same location, overtopping occurs for storm events exceeding the capacity of existing culverts.

The existing condition model received from West Yost and Associated was updated for the area located upstream of Union Pacific Rail Road (UPRR). Based on the available topographic data, the larger sheds were sub-divided into smaller sub-sheds. Surveyed information was used to update various conveyance elements. For the added small sub-sheds the shed width was calibrated so that the resulting peak flows are close to the peak flows from the City of Dixon Standard Charts. The storage for localized ponding areas was updated. See Drainage Exhibit A for the existing condition drainage. The XP-SWMM model summary attached in appendix A, has been printed for the project area and sufficient downstream area to represent the node inflow, ponding elevations at various control points and peak flows through various conveyance elements.

Following is the summary of existing conditions:

- i. The NEQ receives flows from 2690 acres of agricultural area (Basin D1 per Dixon Storm Drain Report). The flows from these 2690 acre basin D1 accumulate upstream of I-80 causing ponding in the area adjacent to I-80 near N. First Street (SR-113) overpass.
- ii. At I-80, the 100-year storm event causes overtopping with a ponding elevation of 66.2 ft on the upstream. For the 10-year storm event the ponding elevation is 65.1 feet, no over-topping occurs.
- iii. The project receives offsite flows from the north in the west roadside ditch running along Pedrick Road.
- iv. The project site receives offsite flows across west property line via existing 42" SID irrigation pipe (Solano Irrigation District – irrigation pipe that serves as drain pipe in winter) and overland sheet flow. For the 100-year storm event the ponding elevation at the low-lying area located on the property west of the project is 62.2 ft, the peak flows into the project are 198.6 cfs. For the 10-year storm event the ponding elevation at the low-lying area located on the property west of the project is 60.6 ft, the peak flows into the project are 44.6 cfs.
- v. The drainage from the project flows east across Pedrick Road through existing CMP culvert and overland. For the 100-year storm event the ponding elevation at the low-lying area located on the project site is 58.86 ft, the peak flows out of the project are 220.3 cfs. For the 10-year storm event the ponding elevation at the low-lying area located on the project site is 57.6 ft, the peak flows into the project are 205.2 cfs, Pedrick Road gets overtopped

- for 10-year storm event too.
- vi. The drainage from the project flows easterly in the existing farm swale; that is not maintained by any public agency. The UPRR tracks are elevated and the limited capacity of existing culverts causes widespread ponding in the farms located between UPRR and Pedrick Road.
 - vii. The 360 acres agriculture area located north west of I-80, basin G1 (Part of Basin G, as identified in the Dixon Storm Drain Report) drains to NEQ through 3-24" CMP Culverts and one 36" RCP culverts. Both 100-year and 10-year storm peak flows (58 cfs and 31 cfs respectively) are conveyed by the culverts; no overtopping of I-80 occurs at this location. The drainage Flying J parcel (55 acres) and Basin G1 flows easterly in the ditch along I-80 off ramp for Pedrick Road and crosses Pedrick Road just south of the I-80 / Pedrick Road interchange. The existing CMP culvert under is almost plugged, the flows mostly go overland across Pedrick Road and to south in the western roadside ditch along Pedrick Road.
 - viii. The drainage from the entire basin D1 and Basin G 1 hits the UPRR and causes widespread ponding in the area located between Pedrick Road and UPRR. The outfall is restricted to only two culverts (27" CMP and 36" RCP under the UPRR railroad) and one 24" CMP culvert under Robben Road. The ponding elevations and the peak outflows for the 100-year and 10-year storm event are listed on the existing condition drainage exhibit A.

The existing condition drainage analysis has been summarized on the Drainage Exhibit A for the 10-year and 100-year design storm events. (See Appendix A)

V POST-DEVELOPMENT DRAINAGE:

The post-development drainage has been addressed for the proposed Dixon Downs (Project). With development of the project, the existing 260 acres of agriculture land will be converted into a multi-use development consisting of a self contained Horse Racing Facility, including a race track, pavilion, horse barns, dormitory accommodation for the staff, a park, a 2 million square foot shopping facility, a hotel, a theater and a few other supportive infrastructure facilities.

- The project will receive the existing offsite drainage at its west boundary; by installing twin 60" drains under future Professional Drive. In the interim conditions, the pipe capacity will be reduced to equivalent of 42" drainpipe, and receiving the sheet flows as sheet flow across the road. The offsite flows and the onsite flows from the Barn area will be routed through the channel (The Water Quality flows from the horse walk path area will be intercepted up-to 25-year-24hour storm event and discharged into sanitary sewer).
- The drainage from the channel will be conveyed easterly in twin 66" drains to Pedrick Road to a diversion structure. The diversion structure will have two outlet drain pipes (48" and 27") discharging to the existing ditch. The diversion structure will have one 48" drain and one 18" drain connected to the infield detention pond piped drainage system. As the outfall pipes (1-27" and 1-48") are smaller than the inflow pipes (2-66"), the stormwater will back-up into the track-detention pond

via 48" drain and 18" drain and bubble-up from the drain inlets at the bottom of the detention pond. The 48" drain will have flap gate to allow inflow into the detention pond, but no outflow. For outflow from the infield detention pond, an 18" drain is proposed that will allow free flow into and out of the detention pond.

- The average detention pond bottom has been established at 57.00 (NGVD). The storage of storm water will cause 100-year ponding elevation of 60.0 feet, and 10-year ponding elevation of 57.9 feet. The ponding duration will be approximately 10 days for a 100-year 4-day storm and 3.5 days for 10-year 24-hour storm.
- The project area located north of barns will be drained to the onsite detention pond located in the racetrack in piped drainage system (To be designed to convey 10-year storm per City Standards) with an overland release to the water quality swales located near outer perimeter of the track. During the design stage of the project the 100year design flows will be piped from the vegetative swales to the infield pond to minimize overtopping of the race-track.
- The detention pond will serve as a private detention pond. For the smaller storm events, the drainage will be conveyed in the piped drainage system, located at bottom of the detention pond to drain the pond area. For larger storm events the drain inlets in the track field area will bubble-up and use the storage area in the track field. The outfall pipe will be 18".
- For modeling purpose an 18" outfall has been modeled from the detention pond and it shows a prolonged detention on the pond for 100-year 4-day storm event. Once the downstream drainage (East of Pedrick) is contained within the non-maintained swale section the sluice-gate/ flap-gate combination on the 48" drain will be opened by the City Staff to empty the in-field detention pond.
- The project will convey the post-developed drainage across Pedrick Road via one 27" drain and one 48" drain through a bubble-up structure to discharge the outflows into the existing non-maintained drainage channel. As studied in the existing condition drainage, the Pedrick Road gets frequently flooded. It will be necessary to raise the Pedrick road profile to meet City Drainage Standards near the drainage crossing to an elevation of 59 feet (2 feet from the existing profile at the lowest point).

See Drainage Exhibit B – Post Development Drainage, in appendix B. The post development drainage summary for the ponding elevations and the peak flows is also included in appendix B.

VI NEQSP – POST DEVELOPMENT DRAINAGE and OUTFALL OPTIONS:

Ken Giberson, McKay & Soms, representing the City of Dixon had expressed concerns in his email dated August 12, 2004 on following two issues:

- a. The drainage outfall from NEQ. How the outflows from NEQ will be routed to the Tremont 3 system with the non-maintained farm swales.
- b. The performance of ultimate NEQ drainage system with multiple isolated detention ponds.

As evident from the Existing Condition Drainage Analysis that has been reviewed and

accepted by the West Yost & Associates. The drainage from NEQ flows across Pedrick Road and causes ponding in the farms west of UPRR. The existing culverts under UPRR and Robben Road convey the drainage to Tremont 3 directly at Robben Road and across UPRR to non-maintained drainage swales that ultimately discharge into the Tremont 3. *Tremont 3 drainage system is the receiving facility for drainage from NEQ.* The Dixon Downs project will meet the CEQA requirements by providing the onsite detention and reducing the post-development peak flows to a level equal or below the pre-development peak flows at its upstream and downstream hydrologic boundaries. The ponding elevations in the area between Pedrick and UPRR are equal or below the existing drainage conditions. To provide maintainable outfall from NEQ is beyond the scope of this project.

However, to address the concerns, following two outfall options to route the drainage from NEQ to Tremont 3 has been considered:

OUTFALL OPTION – 1:

An open channel from Pedrick Road to Tremont 3:

Following are the issues that require consideration to pursue this option:

- i. It will involve land acquisition from the private owners that are located in County of Solano. Approximately 11.5 acres of land will be required for construction of 6700 feet long channel with 5 feet bottom width, 5 feet deep with 4:1 side slopes and 28 feet wide access road.
- ii. Existing wetlands in the non-maintained swales will require mitigation.
- iii. Bore and Jacked culverts under UPRR tracks.
- iv. Providing improved drainage to the area located between Pedrick a UPRR, where considerable ponding occurs in the existing conditions, may amount to loosing the existing natural storage volume.

Considering the constraints with this outfall option, this option has not modeled.

OUTFALL OPTION – 2:

A drainpipe South in Pedrick then East in Vaughn Road to Tremont 3:

Following are the issues that require consideration to pursue this option:

- i. This option will require construction of 8300 lineal feet of storm drain (66" diameter modeled) including bore and jack under railroad tracks.
- ii. This option will not require land acquisition. The storm drain can be constructed within the existing public right of way for Pedrick Road and Vaughn Road.
- iii. Any proposed improvements beyond City of Dixon City limits will require improvement plan review and approval by County of Solano.
- iv. By sizing the proposed outfall via Vaughn Road for the 10-year storm event and letting the excess peak flows beyond 10-year storm event to its historic receiving facilities, the existing natural storage caused by ponding between Pedrick Road and UPRR will be best utilized as offline detention. The existing flooding in the subject area will be considerable reduced by diverting the storm events up to 10-year return period and also by making the existing

culvert capacity available for smaller storm events.

- v. This outfall option will meet the City of Dixon Drainage Design criteria for having the piped drainage system for the 10-year storm event and safe overland release for the storm events exceeding the 10-year return period.

Considering the above mentioned issues, it has been determined that a piped drainage system in Vaughn Road to Tremont 3 with a capacity to convey 10-year storm event and letting the drainage exceeding the 10-year return period spill on to the existing non-maintained drainage swales will be a better and functional alternative. A hydrologic and hydraulic model has been prepared to study a conceptual NEQ ultimate drainage system

NEQ ultimate major drainage components has been modeled as listed below:

- A Linear Pond along I-80 (34acre-ft storage volume); this can be accommodated in the landscaping buffer strip along I-80 with some possible adjustments to the pond configuration so as to provide equivalent detention storage. This pond will intercept the overland flows coming across I-80 and moderate the very high peak flows that occur once I-80 is overtopped.
- A drainpipe (54" diameter modeled) to the expanded AKT Pond.
- The existing AKT retention pond has been modeled as expanded (85 acre-ft storage) and modified as a Detention Pond.
- The southeast portion of (Sub-shed) NEQ can drain directly to outfall pipe.
- Basin G1 (The Agricultural area north of I-80) will be provided a through drainage via Flying J parcel and the 40acre NEQ area located east of Pedrick Road.
- To address future development of Flying J parcel and 40 acres of NEQ, an offline shallow detention (32 acre-ft storage) has been modeled in the 20 acre Agriculture buffer area.
- At the point of discharge for the existing condition, a diversion structure has been modeled with a rectangular orifice outfall to allow spillage for the storm events exceeding 10-year return period.

The results for the NEQ overall drainage with piped outfall in Vaughn Road to Tremont 3 system are included in Appendix C.

Downstream Impacts of Proposed Outfall Improvements:

Both of the outfall options will involve, increased peak flows for the existing Tremont 3 drainage system. Dixon Watershed Management Plan (DWMP), prepared by West Yost & Associates for Solano County Water Agency had studied these outfall options and discharge options in detail. The City of Dixon has adopted Joint Powers Agreement on September 28, 2004 per resolution No. 04-197 outlining the resolution to the outfall issues from Northeast Quadrant and required improvements to the downstream regional drainage systems. The regional drainage issues are beyond the scope of this report, however the project will participate in the downstream drainage solutions based on the fair share for costs and the benefits received by the project.

VII STORMWATER QUALITY MANAGEMENT PLAN:

The storm water quality runoff from the project site will be provided with treatment control BMP's prior to draining it to the public drainage system based on the California Storm Water Quality Association Best Management Practice Handbook for New-development and Re-development, January 2003 (CASQA). For the storm water quality purposes the project site has been divided into 7 sub areas. The northern four sub areas (N1 through N4) will be commercial developments that will have water quality swales as BMP's. The first flush (Runoff generated from 0.2" per hour of rainfall intensity) will be routed through the vegetative swale prior to discharge into the in-field detention pond. The detention pond and the racetrack area is a pervious area, therefore, does not require treatment control BMP for the stormwater.

The sub area consisting of the service area to the south will have support systems for the project site, that is likely to have repair, storage facilities for the project. The vegetative swale for this area will have a fore bay and a 2 feet high gravel berm to allow settling of very large sized particles and separation of the floating particles. The fore bay will add redundancy to the drainage system to contain any accidental spills from the service area before it is drained to the public drainage system.

The stormwater quality runoff (First Flush) from the Barn area has been discussed in detail along with an overview of the overall project Stormwater Quality Management Plan, prepared by HDR, Inc. attached is appendix D.

The abovementioned BMP's have been recommended based on pre-design information for the project. If it becomes necessary to change the BMP's for any of the sub area, the BMP's will be selected from any one or a combination of the following BMP's as referenced from California Storm Water Quality Association Best Management Practice Handbook for New-development and Re-development January 2003. (CASQA):

1. Water Quality Vegetative Swale: BMP TC-30
2. Vegetated Buffer Strip: BMP TC-31
3. Bio-Retention: BMP TC-32
4. Media Filter; BMP TC-40
5. Wet Vaults: BMP MP-50
6. Vortex Separator: BMP MP-51

Operation and Maintenance of BMP's:

The project will enter into a maintenance agreement with City with a commitment to maintain and keep the BMP's operational to the standards recommended in the CASQA BMP handbook or as required by the City with the improvement plan stage.

