

**KOCH CAMPUS ADDITION
DRAINAGE REPORT**

**KOCH
INDUSTRIES**

PROJECT NO. 35-12275-7208

PREPARED BY
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I. Hydrology Analysis

The Koch industries site on the south side of 37th Street North is planning an expansion to its campus complex. Future buildings, internal roads and parking lots are planned. Drainage from these facilities will be directed to proposed retention ponds on the east and west sides of the property. A small southeastern portion of the site will not drain into the planned detention ponds. Figure 1 displays the site's Existing Drainage Conditions and Figure 2 displays the Proposed Drainage Conditions.

Two drainage basins were defined on the property. One basin flows to the planned pond on the west side of the property and the other basin flows to the southeast. The most southern portion of the platted property will remain undeveloped within a KDHE Environmental Use Control (EUC) area.

Site soils are HSG type B according to the Sedgwick County Soils Survey. Table 1 displays the pre-development and post-development curve number computations for the 132.8 acre drainage area to the west pond. The west basin curve number is 84.92 in the pre-development condition and 92.42 in the post-development condition. Existing impervious areas within the design drainage basin are not applicable to the volume required for channel bank protection so the watershed is correspondingly reduced to 90.70 acres.

Table 2 indicates the 18.11 acre east drainage basin with curve numbers of 84.19 in the pre-development condition and 96.89 in the post-development condition. These tables also display the breakdown of individual land use areas for the water quality volume calculation and applicable channel bank protection volume. Existing impervious areas within the design drainage basin are not applicable to the volume required for channel bank protection so the watershed is correspondingly reduced to 13.49 acres.

Due to the highly urbanized state of the site, the time of concentration used for the hydrology analysis was determined as pavement sheet flow at 2 feet per second. An approximate flow distance of 3000 feet to the west pond yields a proposed condition time of concentration of 25 minutes. A longer time of concentration of 33 minutes was used for the existing condition to simulate less peak runoff flow rates for conservatism.

The future east retention pond's time of concentration was estimated from approximately 1600 feet of paved path length at 2 feet per second yielding a time of concentration of 13.3 minutes. A longer time of concentration of 25 minutes was used for the existing condition to simulate less peak runoff flow rates for conservatism. Tables 7 and 8 display an adequate peak runoff flow rate reduction.

II. WATER QUALITY

The drainage basin to the west of 132.8 acres is comprised of open space and existing impervious area; with additionally planned buildings, parking lots and roads. All of the new impervious area and 30% of the existing impervious area was used to determine the volume of water quality needed to be in the permanent pool volume of the west detention pond. The water quality volume is 6.68 acre-feet (AF). An additional 7.5 AF of sediment volume is anticipated. The planned permanent pool volume of the west pond at the static level will be approximately 52 AF. Consequently both water quality and sediment accumulation volumes are met with the proposed west pond. See Table 3.

The drainage basin to the east of 18.11 acres is comprised of open space and existing impervious area; with additionally planned buildings, parking lots and roads. All of the new impervious area and 30% of the existing impervious area was used to determine the volume of water quality needed to be in the permanent pool volume of the east detention pond. The water quality volume is 1.31 AF. An additional 1.12 AF of sediment volume is anticipated. The planned permanent pool volume of the east pond at the static level will be approximately 6.0 AF. Consequently both water quality and sediment accumulation volumes are met with the proposed east pond. See Table 4.

III. CHANNEL PROTECTION

To meet the city's channel bank protection requirement, a 1.25-foot weir will be installed within the west detention pond's outfall weir structure to restrict the discharge of the 1-Year, 24-hour rainfall event. The outfall structure will be a two stage concrete weir. The first stage weir will be 1.25 feet in width with vertical sides restricting the 1-year, 24-hour rainfall to approach a 24 hour detention time, but also to discharge the complete storm within 96 hours.

The east detention pond's outfall weir structure will also have a two stage weir with a lower six inch weir to restrict the discharge of the 1-Year, 24-hour rainfall event for a 24 hour detention time and discharge within 96 hours.

The enclosed HEC-HMS stormwater computer model includes a routing analysis of the 1-year, 24-hour storm for both ponds showing an adequate flow discharge delay.

IV. FLOOD DETENTION

The second stage of the west pond's weir structure will be ten feet in width with 4:1 sloped sides tying into the pond's earthen embankment. The proposed pond and outfall structure will reduce the peak discharge rate from the pond to less than the pre-condition peak rate of runoff from the watershed for the 2, 5, 10, 25 and 100-year rainfall events. Table 5 displays the pond stage-storage data. Table 7 displays HEC-HMS model discharge rate results.

The second stage of the east pond's weir structure will be 22 feet in width with 4:1 sloped sides tying into the pond's earthen embankment. The proposed pond and outfall structure will reduce the peak discharge rate from the pond to less than the pre-condition peak rate of runoff from the watershed for the 2, 5, 10, 25 and 100-year rainfall events. Table 6 displays the pond stage-storage data. Table 8 displays HEC-HMS model discharge rate results.

Tables 9 and 10 display outflow rating curves of the west and east pond's discharge weirs respectively.

A southeastern portion of the site cannot be directed to either retention pond. Future parking areas K (0.71 acres), M (0.23 acres) and some existing parking area (5.28 acres) comprise a 7.09 acre drainage basin with other open space that will continue to flow to the south. The water quality volume of this runoff is approximately 0.34 AF. The permanent pool volumes of both retention ponds far exceed the required amount of water quality volume from their respective watersheds and this small volume. See Tables 1 to 4.

The runoff from this portion of the site for the various design storm frequencies is shown in Table 7. Site peak discharge attenuation provided by the west retention pond accommodates this drainage area. Hydrology and water quality computations for this area are presented in Table 11.

Stormwater modeling was performed with HEC-HMS software. A copy of the computer model is included on a CD.

The site is not within a FEMA regulated floodplain.

The project will involve the relocation of a stream that runs through the property. The stream's drainage basin is less than 240 acres and a DWR channel change permit will not be required. The north portion of the plat area that drains to the north boundary of relocated 37th Street North will be diverted along the roadway into the stream relocation that bypasses the planned west retention pond.

The stream relocation is under the jurisdiction of the Corps of Engineers and an appropriate permit will be obtained.

The proposed ponds and their embankments will not meet the State of Kansas' dam threshold requirement of 50 AF.



City of Wichita/Sedgwick County Subdivision Drainage Plan Checklist



Submit completed forms to:
City of Wichita Public Works & Utilities, 455 N. Main 8th Floor, Wichita KS 67202; or
Sedgwick County Stormwater Management, 1144 S. Seneca, Wichita KS 67213.

Project Name:	Koch Industries Expansion		
Total Area of Project:	158.0	acres	
Development Type:	Industrial	Other:	
Developer Name:	Koch Industries	Contact: James L. Schmidt	Phone: (316) 838-2465
Email:	schmid3j@kochind.com		
Engineer Name:	PEC	Contact: Joe Hickle, P.E.	Phone: (316) 262-2691
Email:	joseph.hickle@pec1.com		

Directions:

- (1) Fill-out this checklist completely and include it with the Drainage Plan submittal. This checklist should be included in the bound copy, behind the cover sheet for the submittal. Incomplete Drainage Plans and checklists will not be accepted.
- (2) Indicate whether a plan element is included or not included in the submittal by choosing "Yes" or "No" from the dropdown list in the "Element Included?" column. The question must be answered for every plan element for this checklist to be considered complete. An explanation must be provided for all "No" answers.

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
1.0	General Information		
1.1	Digital copy of drainage plan, including preliminary Master Grading Plan, preliminary plat and proposed plat, in PDF format and one half size, bound, paper copy.	Yes	
1.2	Professional Engineer's seal, signature and date on plan cover.	Yes	
1.3	Site location map, using color ortho-imagery and showing the project boundaries, a north arrow and an accurate scale.	Yes	
1.4	Narrative of the development type, existing conditions and proposed impacts on stormwater runoff, wetlands, riparian zones and floodplains/floodways.	Yes	
1.5	Discussion of off-site conditions surrounding the proposed development.	Yes	
1.6	Summary table of runoff calculations (pre/post development).	Yes	
1.7	Narrative description of the type and function of the permanent structural stormwater management facilities.	Yes	
2.0	Existing Conditions Information		
2.1	Existing Conditions Drainage Map		
2.1.1	On-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.	Yes	
2.1.2	On-site and off-site drainage features, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.	Yes	
2.1.3	Storm sewer system components, including storm drains, inlets, catch basins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.	Yes	
2.1.4	Location and boundaries of natural features such as wetlands, lakes, ponds with the normal water elevation noted, rock outcroppings, wooded areas and tree rows.	N/A	
2.1.5	Location, dimensions and elevations of existing bridges and culvert crossings.	Yes	
2.1.6	Location of existing utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	Yes	
2.1.7	Groundwater elevations, if applicable.	N/A	
2.1.8	Delineation of predominant soil based on USDA soil surveys and/or on-site soil borings; indicate NRCS soil name and Hydrologic Soil Group for undisturbed surface soils.		See Calculation Narrative
2.1.9	Land use types per NRCS nomenclature.	N/A	
2.1.10	Footprint of existing impervious areas (labeled, area given in acres).		See Calculation Tables
2.1.11	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).		
2.1.12	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).	Yes	See Calculation Narrative

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
2.2 Existing Conditions Hydrology and Hydraulics Analysis			
2.2.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	Yes	
2.2.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	Yes	
2.2.3	Table of existing condition runoff curve numbers with supporting data and calculations.	Yes	
2.2.4	Table of existing condition times of concentration with supporting data and calculations.		
2.2.5	A summary table of rainfall data used in the hydrologic analysis, and a reference for the source of the data.	Yes	
2.2.6	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as required to illustrate the basis for hydraulic analysis.	N/A	
2.2.7	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	Yes	
3.0 postdevelopment Conditions Information			
3.1 postdevelopment Conditions Drainage Map			
3.1.1	Proposed project boundary.	Yes	
3.1.2	on-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.	Yes	
3.1.3	Existing on-site and off-site drainage features that are to remain after development, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.	Yes	
3.1.4	Location and description of off-site through-drainage conveyances which are confined to an easement, dedication and/or reserve.		See Proposed Plat
3.1.5	Footprint of proposed impervious areas, including roads, parking lots, buildings and other structures.	Yes	
3.1.6	Location of proposed utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	Yes	
3.1.7	Delineation of predominant soils, based on anticipated soil textures and NRCS guidelines if different from predevelopment soil conditions; indicate NRCS soil name and Hydrologic Soil Group for surface soils.		See Calculation Narrative
3.1.8	Land use cover per NRCS nomenclature.	N/A	
3.1.9	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).		See Calculation Tables
3.1.10	Proposed limits of land disturbing activity (i.e., grading limits).	Yes	
3.1.11	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).	Yes	See Calculation Narrative
3.2 Proposed Conveyances Map			
3.2.1	on-site and off-site drainage features, including perennial and intermittent streams (with names labeled), proposed conveyance systems (such as open channels, ditches, swales and areas of overland flow, including backyard drainage). Flow direction must be indicated by arrows.	Yes	
3.2.2	Storm sewer system components, including storm drains, inlets, catchbasins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.		To be provided on final design plans in process
3.2.3	For any subbasin or drainage area > 40 acres, show that the stormwater flow is confined to an open channel with required side benches and freeboard, or conformance to applicable policy and design requirements if partially enclosed.	N/A	
3.2.4	Location(s) of stormwater management facilities and any associated drainage easements.	Yes	See proposed plat
3.2.5	Proposed energy dissipaters and other channel protection devices.	N/A	
3.2.6	Location(s) and dimension(s) of proposed channel, bridge and culvert crossings.	Yes	
3.2.7	Normal pool and 100-year pool elevations for ponds and lakes.	Yes	
3.2.8	Permanent concrete outfall control structure(s) for ponds.	Yes	See Figure 2
3.2.9	Emergency overflow spillways and top of berm elevations for ponds and other volume/peak discharge control facilities.	Yes	
3.2.10	Floodplains, ponds, and stormwater management facilities located in reserves.	N/A	
3.3 postdevelopment Conditions Hydrology & Hydraulics			

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
3.3.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	Yes	
3.3.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	Yes	
3.3.3	Table of postdevelopment condition runoff curve numbers with supporting data and calculations.	Yes	
3.3.4	Table of postdevelopment condition times of concentration with supporting data and calculations.		See Calculation Narrative
3.3.5	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	N/A	
3.3.6	Downstream peak discharge assessment (10% Rule) results and supporting data and calculations. Provide digital copies of any computer files and models used.	Yes	
3.3.7	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.	N/A	
3.3.8	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.	Yes	
3.3.9	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.	Yes	
3.3.10	Demonstrate that runoff from the proposed project site is discharged in the same manner as prior to development, using level spreaders, energy dissipaters, other devices or grading as required, or identify an appropriate flowage easement.	Yes	
3.3.11		Yes	
3.4 Stormwater Quantity Control Sizing			
3.4.1	Hydraulic sizing calculations for all stormwater management controls.	Yes	
3.4.2	Table(s) listing all stormwater management controls. Present the types, sizes, elevations, flows, velocities and depths for each control, as applicable. Verify that velocities are self-cleaning and non-erosive.	Yes	
3.4.3	Typical details (including cross-sections where applicable) for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.		See Calculation Tables
3.5 Stormwater Quality Management Facilities			
3.5.1	Table(s) listing all stormwater management facilities. Present the description, % TSS removal value, water quality volume handled, contributing drainage area in acres and contributing impervious area in acres.	Yes	
3.5.2	Indicate the responsible party for maintenance, as shown in the plat text (i.e., Home Owners Association, Lot Owners Association, property owner, etc.).	Yes	The Owner
3.5.3	Water quality volume (total and by facility), with supporting data and calculations.	Yes	
3.5.4	% TSS removal value (total and by facility) with supporting data and calculation. Must be equal to or greater than 80%.	Yes	
3.5.5	Channel protection volume with supporting data and calculations.		See Calculation Narrative
3.5.6	Water quality volume and channel protection volume orifice size calculations.	Yes	See Calculation Narrative
3.5.7	Other calculations required for each stormwater management facility as specified in the Wichita/Sedgwick County Stormwater Manual.	N/A	
3.5.8	Typical details (including cross-sections where applicable) for outlet structures, embankments, internal grading, forebays and other siltation prefilters, filtration/infiltration media, vegetation, check dams, operational controls, etc.	N/A	
4.0 Floodplains			
4.1	Reference the source of flood profile, floodplain, floodway and stream discharge information.	N/A	
4.2	Delineation of nearest base flood elevations.		
4.3	Delineation of predevelopment regulatory floodplain/floodway limits using FEMA's current GIS database; limits to be per elevation and scaled location.	N/A	
4.4	Delineation of postdevelopment regulatory floodplain/floodway limits; limits to be per elevation and scaled location, with project limits shown.	N/A	
4.5	Floodway data table and discharges.	N/A	
4.6	Hydrologic and hydraulic study information for local floodplain analysis, unnumbered Zone A elevation determinations and floodplain map revisions or required permits.	N/A	
4.7	Regulatory floodway and four natural profile models (10, 50, 100 and 500-year) for existing and postdevelopment conditions.	N/A	
4.8	Floodplains and floodways located within a reserve, where necessary.	N/A	

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
4.9	Floodplain cut and fill calculations for volume sensitive basins.	N/A	
4.10	Demonstrate that floodway elevations and velocities do not increase due to construction in the floodway ("No Rise Certification").	N/A	
5.0 Federal, State and Local Permits			
5.1	US Army Corps of Engineers regulatory program permits (Section 404 permit)		Permit for stream impacts being obtained
5.2	Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Floodplain Fill, Levee, Water Appropriations, Dam Safety permit, etc.)		Permit for water appropriations being obtained
5.3	FEMA letters of map change/revision - LOMA, LOMR, LOMR-f, CLOMR, etc.; shall be included and approved when project modifies the limits of the floodplain/floodway.	N/A	
6.0 Half Scale Preliminary Master Grading Plan			
6.1	One set of plans and associated PDF of plans.	Yes	See Figures 3A, 3B, 3C and 3D
6.2	Professional Engineer's seal, signature and date.	Yes	
6.3	Title block including subdivision name and phase and dated revision documentation.	Yes	
6.4	Future phases shown but cross-hatched as information only.	Yes	
6.5	Scale, not greater than 1-inch = 60 feet.	Yes	
6.6	North arrow.	Yes	
6.7	Index or legend key.	Yes	
6.8	Benchmarks (minimum of 2) used for site control (NAVD 88 vertical datum).	Yes	
6.9	Existing contours of entire site with contour interval of one foot.	Yes	
6.10	Proposed contours for channels, ponds, and other permanent stormwater management facilities, with contour interval of one foot.	Yes	
6.11	Spot elevations shown to the nearest tenth of a foot for critical locations, including lot and property boundaries.	Yes	
6.12	Proposed lot and street layout.	Yes	
6.13	Locations of underground storm drains.	Yes	
6.14	Overflow locations for storms exceeding storm drain capacity, with elevations.	Yes	
6.15	Top elevations of storm drains at all inlets, manholes, and flow line elevations for all outfalls.	Yes	
6.16	Locations of open ditches and lakes.	Yes	
6.17	Flow direction arrows.	Yes	
6.18	Proposed flow line elevations of all open ditches at maximum 100 foot intervals, and 100-year flood elevations thereon.	N/A	
6.19	Ponds: Location, bottom elevation, normal pool elevation, 100-year flood elevation, emergency overflow elevation.		See Calculation Tables
6.20	Proposed top-of-curb elevations at points where drainage will be required to flow over the curb.	Yes	
6.21	Platted minimum building opening elevation for each lot, in table form for all lots (excluding basement floor elevations).		See Grading Plan
6.22	Standard foundation and elevation detail for slab on grade, full basement, view-out, partial view-out and/or walk-out construction.		See Grading Plan
6.23	Top of foundation elevation for each lot.	N/A	
6.24	Notation for builders for each lot as to the type of structure that may be constructed and the view-out, walk-out or pad elevation, as applicable.	N/A	
6.25	Indicate that all lots are above the 100-year flood elevation.	Yes	
6.26	Indicate that grading around structures conforms to perimeter drainage requirements.	N/A	
6.27	Indicate that backyard drainage grading conforms to backyard drainage requirements.	N/A	
6.28	Adjacent subdivision lot lines, with lot labels and subdivision names.	N/A	
6.29	Boundaries and labels for all easements, rights-of-way and reserves.	Yes	
6.30	Statement on proposed final plat: "A drainage plan has been developed for the subdivision and all drainage easements, rights-of-way, or reserves shall remain at the established grades and remain unobstructed to allow for the conveyance of stormwater."	Yes	
End of Checklist			

KOCH EXPANSION WEST POND
DEVELOPMENT AREA WATER QUALITY CALCULATION
TABLE 1

AREA NAME	WATER QUALITY TREATMENT				POST WATERSHED			CPV			PRE WATERSHED			KDJH Sediment
	IMPERV ACRES	30% ACRES	100% ACRES	Rf	RfA	PROVIDED ACRES	CN	ACRES	CN	ACRES	CN	ACRES	CN	
A - PARKING	1.70	0.95	1.70	0.95	1.62	1.70	98	166.81	98	166.81	1.70	80	136.17	1.70
B - PARKING	1.16	0.95	1.16	0.95	1.10	1.16	98	113.51	98	113.51	1.16	80	92.66	1.16
C - PARKING	7.17	0.95	7.17	0.95	6.82	7.17	98	703.10	98	703.10	7.17	80	573.96	7.17
D - PARKING	4.18	0.95	4.18	0.95	3.98	4.18	98	410.07	98	410.07	4.18	80	334.75	4.18
E - PARKING	0.73	0.95	0.73	0.95	0.69	0.73	98	71.12	98	71.12	0.73	80	58.06	0.73
F - PARKING	2.89	0.95	2.89	0.95	2.74	2.89	98	283.03	98	283.03	2.89	80	231.05	2.89
G - PARKING	6.05	0.95	6.05	0.95	5.75	6.05	98	593.14	98	593.14	6.05	80	484.20	6.05
H - PARKING	0.72	0.95	0.72	0.95	0.68	0.72	98	70.56	98	70.56	0.72	80	57.60	0.72
I - PARKING	0.44	0.95	0.44	0.95	0.42	0.44	98	43.59	98	43.59	0.44	80	35.58	0.44
L - PARKING	0.48	0.95	0.48	0.95	0.45	0.48	98	46.72	98	46.72	0.48	80	38.14	0.48
EX. T PARKING	0.70	0.21	0.00	0.95	0.20	0.70	98	68.60	98	68.60	0.00	80	56.00	0.00
NEW ROADS	9.60	0.95	9.60	0.95	9.12	9.60	98	940.80	98	940.80	9.60	80	768.00	9.60
EXISTING ROADS	11.50	0.95	3.45	0.95	3.28	11.50	98	1127.00	98	1127.00	0.00	98	1127.00	0.00
SIDEWALKS	5.10	0.95	5.10	0.95	4.85	5.10	98	499.80	98	499.80	5.10	98	499.80	5.10
BUILDING A	0.84	0.25	0.00	0.95	0.24	0.84	98	82.00	98	82.00	0.00	98	82.00	0.00
BUILDING B	0.32	0.10	0.00	0.95	0.09	0.32	98	31.50	98	31.50	0.00	98	31.50	0.00
BUILDING C	0.46	0.14	0.00	0.95	0.13	0.46	98	45.56	98	45.56	0.00	98	45.56	0.00
BUILDING D	0.93	0.28	0.00	0.95	0.26	0.93	98	91.12	98	91.12	0.00	98	91.12	0.00
BUILDING E	5.22	1.57	0.00	0.95	1.49	5.22	98	511.56	98	511.56	0.00	98	511.56	0.00
BUILDING F	1.10	0.33	0.00	0.95	0.31	1.10	98	107.80	98	107.80	0.00	98	107.80	0.00
BUILDING G	0.83	0.25	0.00	0.95	0.24	0.83	98	81.34	98	81.34	0.00	98	81.34	0.00
BUILDING T	1.56	0.47	0.00	0.95	0.44	1.56	98	152.98	98	152.98	0.00	98	152.98	0.00
BUILDING H	1.33	0.95	1.33	0.95	1.26	1.33	98	130.34	98	130.34	1.33	80	106.40	1.33
BUILDING I	1.33	0.95	1.33	0.95	1.26	1.33	98	130.34	98	130.34	1.33	80	106.40	1.33
OTHER	0.00	0.00	0.00	0.95	0.00	0.00	98	0.00	98	0.00	0.00	80	0.00	0.00
POND	5.70	0.95	5.70	0.95	5.42	5.70	100	570.00	100	570.00	5.70	71	404.70	5.70
OPEN SPACE	29.90	0.20	29.90	0.20	5.98	29.90	80	2392.00	80	2392.00	29.90	80	2392.00	29.90
EXISTING NORTH PARKING	11.64	3.49	0.00	0.95	3.32	11.64	98	1140.72	98	1140.72	0.00	98	1140.72	0.00
EXISTING SOUTH PARKING	7.00	2.10	0.00	0.95	2.00	7.00	98	686.00	98	686.00	0.00	98	686.00	0.00
MECH	0.33	0.33	0.33	0.95	0.31	0.33	98	32.34	98	32.34	0.33	80	26.40	0.33
37TH BUFFER	11.88	0.20	11.88	0.20	2.38	11.88	80	950.40	80	950.40	11.88	71	843.48	11.88
TOTAL AREA	132.80				66.83	132.80		12273.84		12273.84	92.42		11113.78	90.70
TREATMENT ACRES REQUIRED	12.63												89.83	7.50
														AF sediment

TREATMENT REQUIRED ACRES 103.33 < X Rv 0.65 6.68 AF

TREATMENT PROVIDED ACRES 132.80 12273.84

TREATMENT TREATMENT PROVIDED ACRES 132.80 12273.84

POND STATIC VOLUME MINIMUM = 14.18 AF

SEDIMENT + WATER QUALITY VOLUME 7.50 AF

POND SURFACE = 5.7 AC

MINIMUM DEPTH = 2.49 FT

PROPOSED DEPTH = 12 FT

PROPOSED POOL VOL = 52 AF

SEE TABLE 3

**KOCH EXPANSION EAST POND
DEVELOPMENT AREA WATER QUALITY CALCULATION
TABLE 2**

H5G-B	AREA AREA NAME	WATER QUALITY TREATMENT			POST WATERSHED			CPV			PRE WATERSHED			KCHE Sediment		
		IMPERV ACRES	30% ACRES	100% ACRES	Rf	R/A	PROVIDED ACRES	CN	ACRES	CN	ACRES	CN	CN			
	J - PARKING	6.21			0.95	5.90	6.21	98.00	608.91	6.21	98.00	608.91	6.21	80.00	497.07	6.21
	K - PARKING	0.00			0.95	0.00	0.00	98.00	0.00	0.00	98.00	0.00	0.00	80.00	0.00	0.00
	NEW ROADS	1.00			0.95	0.95	1.00	98.00	98.00	1.00	98.00	98.00	1.00	80.00	80.00	1.00
	EXISTING ROADS	2.30	0.69		0.95	0.66	2.30	98.00	225.40	0.00	98.00	0.00	2.30	98.00	225.40	0.00
	SIDEWALKS	0.50			0.95	0.48	0.50	98.00	49.00	0.50	98.00	49.00	0.50	98.00	49.00	0.50
	BUILDING E	1.00	0.30		0.95	0.29	1.00	98.00	98.00	0.00	98.00	0.00	1.00	98.00	98.00	0.00
	BUILDING J	1.33			0.95	1.26	1.33	98.00	130.34	1.33	98.00	130.34	1.33	80.00	106.40	1.33
	BUILDING K	1.33			0.95	1.26	1.33	98.00	130.34	1.33	98.00	130.34	1.33	80.00	106.40	1.33
	OTHER	0.00			0.95	0.00	0.00	98.00	0.00	0.00	98.00	0.00	0.00	80.00	0.00	0.00
	EAST POND	1.80			0.95	1.71	1.80	100.00	180.00	1.80	100.00	180.00	1.80	71.00	127.80	1.80
	OPEN SPACE	1.32			0.20	0.26	1.32	80.00	105.60	1.32	80.00	105.60	1.32	80.00	105.60	1.32
	EXISTING EAST PARKING	1.32	0.40		0.95	0.38	1.32	98.00	129.36	0.00	98.00	0.00	1.32	98.00	129.36	0.00
	TOTAL AREA	18.11				13.15	18.11		1754.95	96.89	13.49	1302.19	96.51	18.11	1525.03	84.19
	TREATMENT ACRES REQUIRED =		1.39													1.12 AF sediment
	TOTAL AREA			18.11 CHECK												

TREATMENT
REQUIRED
ACRES

14.88 <

X 1.27/12" PER FT
X RV0.88

1.31 AF

POND STATIC VOLUME MINIMUM =

2.43 AF

SEDIMENT - WATER QUALITY VOLUME

1.8 AC

POND SURFACE =

1.35 FT

MINIMUM DEPTH =

6 FT

PROPOSED DEPTH =

6 AF

PROPOSED POOL VOL =

SEE TABLE 4

**WEST POND PERMANENT POOL VOLUME
TABLE 3**

	ELEV	AC	SF	FT	SF	CF	CF	CF	AF
STATIC	1350	5.68	247421					0	0
				1	242567	242567.0			
	1349	5.46	237713				242,567		5.57
				1	232859	232859.3			
	1348	5.23	228005				475,426		10.91
				1	223152	223151.7			
	1347	5.01	218298				698,578		16.04
				1	213444	213444.0			
	1346	4.79	208590				912,022		20.94
				1	203736	203736.3			
	1345	4.57	198883				1,115,758		25.61
				1	194029	194028.7			
	1344	4.34	189175				1,309,787		30.07
				1	184321	184321.0			
	1343	4.12	179467				1,494,108		34.30
				1	174613	174613.4			
	1342	3.90	169760				1,668,721		38.31
				1	164906	164905.7			
	1341	3.67	160052				1,833,627		42.09
				1	155198	155198.1			
	1340	3.45	150344				1,988,825		45.66
				1	145490	145490.4			
	1339	3.23	140637				2,134,316		49.00
				1	135783	135782.7			
BOTTOM	1338	3.01	130929				2,270,098		52.11

EAST POND PERMANENT POOL VOLUME
TABLE 4

	ELEV	AC	SF	FT	SF	CF	CF	CF	AF
STATIC	1369	1.800	78408					0	0
				1	72600	72600.0			
	1368	1.5333333	66792				72,600		1.67
				1	60984	60984.0			
	1367	1.2666667	55176				133,584		3.07
				1	49368	49368.0			
	1366	1	43560				182,952		4.20
				1	37752	37752.0			
	1365	0.7333333	31944				220,704		5.07
				1	26136	26136.0			
	1364	0.4666667	20328				246,840		5.67
				1	14520	14520.0			
BOTTOM	1363	0.2	8712				261,360		6.00

**WEST POND
RETENTION POND STORAGE
TABLE 5**

	NAVD88 ELEV FT	AREA AC	AREA SF	DEPTH FT	AVG AREA SF	INCR VOL CF	TOTAL VOL CF	POND VOLUMES		
								POOL TOTAL VOL AF	STORM VOL AF	
BOTTOM	1338.00	0.00	0.00					0.00		
				12.00	123710.40	1484524.80				
STATIC	1350.00	5.68	247420.80				1484524.80	34.08	0.00	
				5.00	271689.94	1358449.71				
100YR STAGE	1355.00	6.79	295959.09				2842974.51	65.27	31.19	
				1.40	302754.45	423856.22				
	1356.40	7.11	309549.81				3266830.74	75.00	40.92	
				0.60	312462.10	187477.26				
TOP	1357.00	7.24	315374.40				3454308.00	79.30	45.22	

**EAST POND
RETENTION POND STORAGE
TABLE 6**

							POND VOLUMES			
	NAVD88 ELEV FT	AREA AC	AREA SF	DEPTH FT	AVG AREA	INCR VOL CF	TOTAL VOL CF	POOL TOTAL VOL AF	STORM VOL AF	
BOTTOM	1363	0.200	8712					0		
				6	43560	261360.0				
STATIC	1369	1.800	78408				261,360	6.00	0	
				2.3	91766	211062.7				
100YR STAGE	1371.3	2.413	105125				472,423	10.85	4.85	
				1.2	109190	131028.5				
TOP	1372.5	2.600	113256				603,451	13.85	7.85	

**WEST DISCHARGE
TABLE 7**

	2	5	10	25	100
	YEAR	YEAR	YEAR	YEAR	YEAR
BASIN	CFS	CFS	CFS	CFS	CFS
WEST PRE	228.5	329.4	401.2	493.9	669.1
SOUTH PRE	27.3	36.3	42.5	50.5	65.5
TOTAL	255.8	365.7	443.7	544.4	734.6
WEST POND	39.4	99.5	152.6	229.3	392.8
SOUTH POST	28.7	37.6	43.8	51.7	66.5
TOTAL	68.1	137.1	196.4	281	459.3
MEETS DETENTION REG.					

EAST DISCHARGE

TABLE 8

	2	5	10	25	100
	YEAR	YEAR	YEAR	YEAR	YEAR
BASIN	CFS	CFS	CFS	CFS	CFS
EAST PRE	36	52.1	63.6	78.4	106.5
EAST POND	11.3	27.7	41.5	60.8	97.4
MEETS DETENTION REG.					

**WEST POND DISCHARGE RATING CURVE
TABLE 9**

WEST OUTFLOW CURVE ELEV FT	H FT	C	SLOT L FT	CFS	H FT	C	L FT	TRAP	ELEV FT	WEST
								WEIR		KOCH
								Q CFS		Q CFS
1350.00	0.00	2.69	1.25	0.00				0.00	1350.00	0.00
1350.20	0.20	2.69	1.25	0.30				0.00	1350.20	0.30
1350.40	0.40	2.72	1.25	0.86				0.00	1350.40	0.86
1350.60	0.60	2.75	1.25	1.60				0.00	1350.60	1.60
1350.80	0.80	2.85	1.25	2.55				0.00	1350.80	2.55
1351.00	1.00	2.98	1.25	3.73				0.00	1351.00	3.73
1351.20	1.20	3.08	1.25	5.06				0.00	1351.20	5.06
1351.40	1.40	3.20	1.25	6.63					1351.40	6.63
1351.60	1.60	3.28	1.25	8.30					1351.60	8.30
1351.80	1.80	3.31	1.25	9.99					1351.80	9.99
1352.00	2.00	3.30	1.25	11.67	0.00	2.69	10.00	0.00	1352.00	11.67
1352.20	2.20	3.31		11.67	0.20	2.69	10.00	2.59	1352.20	14.26
1352.40	2.40	3.32		11.67	0.40	2.72	10.00	7.93	1352.40	19.59
1352.60	2.60	3.32		11.67	0.60	2.75	10.00	15.69	1352.60	27.36
1352.80	2.80	3.32		11.67	0.80	2.85	10.00	26.59	1352.80	38.26
1353.00	3.00	3.32		11.67	1.00	2.98	10.00	41.12	1353.00	52.79
1353.20	3.20	3.32		11.67	1.20	3.08	10.00	58.95	1353.20	70.62
1353.40	3.40	3.32		11.67	1.40	3.20	10.00	81.21	1353.40	92.88
1353.60	3.60	3.32		11.67	1.60	3.28	10.00	106.74	1353.60	118.41
1353.80	3.80	3.32		11.67	1.80	3.31	10.00	134.61	1353.80	146.28
1354.00	4.00	3.32		11.67	2.00	3.30	10.00	164.28	1354.00	175.94
1354.20	4.20	3.32		11.67	2.20	3.31	10.00	198.31	1354.20	209.97
1354.40	4.40	3.32		11.67	2.40	3.32	10.00	236.02	1354.40	247.68
1354.60	4.60	3.32		11.67	2.60	3.32	10.00	276.70	1354.60	288.37
1354.80	4.80	3.32		11.67	2.80	3.32	10.00	321.06	1354.80	332.73
1355.00	5.00	3.32		11.67	3.00	3.32	10.00	369.18	1355.00	380.84
1355.20	5.20	3.32		11.67	3.20	3.32	10.00	421.15	1355.20	432.81
1355.40	5.40	3.32		11.67	3.40	3.32	10.00	477.06	1355.40	488.73

EAST POND DISCHARGE RATING CURVE
TABLE 10

EAST OUTFLOW CURVE ELEV FT	H FT	C	SLOT L FT	Q CFS	H FT	C	L FT	TRAP		ELEV FT	EAST	
								WEIR Q CFS			KOCH Q CFS	
1369.00	0.00	2.69	0.50	0.00				0.00		1369.00		0.00
1369.20	0.20	2.69	0.50	0.12				0.00		1369.20		0.12
1369.40	0.40	2.72	0.50	0.34				0.00		1369.40		0.34
1369.60	0.60	2.75	0.50	0.64				0.00		1369.60		0.64
1369.80	0.80	2.85	0.50	1.02				0.00		1369.80		1.02
1370.00	1.00	2.98	0.50	1.49				0.00		1370.00		1.49
1370.20	1.20	3.08	0.50	2.02	0.00	2.69	22.00	0.00	0.00	1370.20	22.00	2.02
1370.40	1.40	3.20	0.50	4.05	0.20	2.69	22.00	5.48	5.48	1370.40	22.00	9.52
1370.60	1.60	3.28	0.50	4.05	0.40	2.72	22.00	16.18	16.18	1370.60	22.00	20.23
1370.80	1.80	3.31	0.50	4.05	0.60	2.75	22.00	31.03	31.03	1370.80	22.00	35.08
1371.00	2.00	3.30	0.50	4.05	0.80	2.85	22.00	51.06	51.06	1371.00	22.00	55.11
1371.20	2.20	3.31		4.05	1.00	2.98	22.00	76.88	76.88	1371.20	22.00	80.93
1371.40	2.40	3.32		4.05	1.20	3.08	22.00	107.54	107.54	1371.40	22.00	111.58
1371.60	2.60	3.32		4.05	1.40	3.20	22.00	144.82	144.82	1371.60	22.00	148.87
1371.80	2.80	3.32		4.05	1.60	3.28	22.00	186.40	186.40	1371.80	22.00	190.45
1372.00	3.00	3.32		4.05	1.80	3.31	22.00	230.53	230.53	1372.00	22.00	234.58

**SOUTH BASIN DISCHARGE
HYDROLOGY & WATER QUALITY COMPUTATIONS**

TABLE 11

LANDUSE	PRE AREA ACRES	PRE CN	CN*A	PRE WT CN	POST AREA ACRES	POST CN	CN*A	POST WT CN	WQ VOLUME AF
OPEN SPACE	1.81	80	144.8		1.1	80	88.0		0.11
PARKING	5.28	98	517.4		5.28	98	517.4		0.16
FUTURE PARKING (K) (M)	0	98			0.71	98	69.6		0.07
	7.09		662.2	93.40	7.09		675.0	95.21	0.34