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MEMORANDUM

CH2MHILL

Evaluation of OSMP Memorandum Dated April 13, 2011

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Introduction

This memorandum will document the evaluation of the Open Space and Mountain Parks evaluations of the South Boulder Creek Alternatives, specifically the Regional Detention Alternatives evaluated by Open Space and Mountain Parks (OSMP) staff in a memorandum dated April 13, 2011. The OSMP staff reviewed the impact of the Proposed Berms for two of the alternatives

1. Regional Detention at US-36 – Alternative 2
2. Distributed Regional Detention – Alternative 5

OSMP evaluated the berms based on the potential environmental, irrigation, and agriculture impacts to Open Space Lands. Specifically the evaluation looked at impacts to the following specific items:

1. Wetlands
2. Riparian Vegetation
3. Preble's Meadow Jumping Mouse U. S. Fish and Wildlife Service (USFWS) Critical Habitat Area
4. Preble's Meadow Jumping Mouse (PMJM) Conservation Zone
5. Ute Ladies' Tresses Orchid
6. Northern Leopard Frog
7. Agricultural Resources
8. Irrigation Resources
9. The Plains Topminnow

10. Bobolink

Assumptions made by the OSMP staff to assess the impacts of the various detention alternatives include placing the entire berm footprint on OSMP lands, would have a 12' foot top width for trail access and maintenance access and would have 4:1 side slopes.

This memorandum provides a more detailed evaluation of the proposed berms and potential impacts to OSMP resources as defined in their memorandum dated April 13, 2011.

Refined Alternative Design

The berms for the two alternatives outlined above were refined based on the concepts provided to WRAB in November 2010. Berms were contoured at a 1' contour interval based on the City of Boulder's 2003 1' Contour information. Contouring included reestablishing links to existing trails, a 20' offset from the existing US36 edge of pavement to accommodate future traffic lanes on US-36, and accommodation for the proposed regional bike trail along US-36. Berms had the following geometrical constraints.

1. 4:1 side slopes typical for all berms
2. 12 foot top of berm width for maintenance and trails access
3. 15 foot construction, access and maintenance easement beyond the toe of all berms and offset from any property lines.

To complete the impact analysis GIS shapefiles were obtained from OSMP staff for the various resources of interest noted in the introduction. Table 1 below lists the shapefiles provided by OSMP and a description of use for estimating impacts to Open Space, critical habitat, or threatened or endangered species.

TABLE 1
Shapefiles from OSMP to estimate impacts to resources due to regional detention berms

Shapefile	Description	Use for Impact Evaluation by OSMP
WetlandsRiparian_VegMap.shp	This shapefile provides an evaluation of the groupings and species of vegetation on OSMP lands including riparian and wetland species.	Impacts to Wetlands/Riparian areas; Northern Leopard Frog Habitat
SouthBldrCrStateNatArea.shp	This shapefile Identifies lands that belong in the South Boulder Creek Natural Area.	Impacts to the South Boulder Creek Natural Area
PreblesCriticalHabitat.shp	This shape identifies the PMJM Critical habitat area defined by the USFWS as a corridor 460 feet adjacent to the South Boulder Creek Channel.	Impacts to the PMJM Critical Habitat Corridor
PreblesConsZones.shp	This shape identifies the PMJM Conservation Zones for the City of Boulder	Impacts to the PMJM Conservation Zones

Impacts to the Ute Ladies' Tresses Orchid were estimated to be the footprint of the berm and 15-wide access easement. Due to the sensitive nature of the species, OSMP declined to provide a GIS shapefile to identify the habitat areas of the Ute Ladies' Tresses Orchid.

The remainder of the impacts to:

1. Agricultural Resources;
2. Irrigation Resources;
3. The Plains Topminnow;
4. and Bobolink;

were qualitatively assessed by the OSMP staff as to the potential impacts to the various resources.

To complete the Refined Alternative Design on the potential berm impacts, the same shapefiles and assumptions made by OSMP staff were applied to identify impacts to the resources of concern. To further help quantify the impacts of the berms additional shapefiles, identified in Table 2, were used to quantify the impacts to:

1. Agricultural Resources;
2. Irrigation Resources including irrigation ditches, laterals and head gates;
3. And City of Boulder Regulatory Wetlands;

TABLE 2
Additional shapefiles provided by the City of Boulder to assess impacts of regional detention berms.

Shapefile	Description	Use for Impact Evaluation by OSMP
OSMP_Headgates.shp	This shapefile identifies head gates on OSMP lands	Impacts to head gates that will need to be rebuilt and reconnected
OSMP_Wells.shp	This shapefile identifies wells on OSMP lands	Impacts to wells on OSMP property
creek_ditch.shp	This shape identifies all irrigation ditches and laterals across the Open Space system.	Impacts to the irrigation ditches and laterals that would require mitigation
Wetlands_regulatory_area.shp	This shapefile identifies the regulatory wetlands identified by the City of Boulder	Impacts to regulatory wetlands that would require mitigation
OSMP_Ag_Fields.shp	This shapefile identifies designated agricultural areas on the OSMP lands	Assess impacts to agricultural lands on OSMP property

Due to the qualitative assessment completed by OSMP staff on the Plains Topminnow and Bobolink and in absence of more defined information on the habitat and potential impacts on these species, the Plains Topminnow and Bobolink were not included in the Refined Alternative Design.

Results

All berms for the two alternatives that contain regional detention facilities were evaluated as part of this review. The tables that follow include a review and comparison of each item of interest described within the OSMP memorandum. All impacts presented in this memorandum would be permanent; construction-related impacts are not included herein.

TABLE 3
Comparison of Maximum Berm Height

Berm ID	Maximum Berm Height (feet) (OSMP Memorandum)	Maximum Berm Height (feet) (Refined Alternative Design)	
		Maximum Berm Height	Maximum Berm Height on OSMP Property
US-36 Regional Detention (Alt 2)	18	23 ¹	15
US-36 Distributed Detention (Alt 5)	18	12 ²	12
South Boulder Road Distributed Detention (Alt 5)	14	14 ³	13
Baseline Road Distributed Detention (Alt 5)	18	18 ⁴	11 ⁵

1. Maximum berm height occurs at the Table Mesa Drive on-ramp to US-36 between Table Mesa Drive and Foothills Parkway.
2. Maximum berm height occurs at the Foothills Parkway on-ramp to US-36 between east of the Foothills Parkway Overpass.
3. Maximum berm height occurs east of South Boulder Creek and as observed from South Boulder Road.
4. Maximum berm height occurs at the South Boulder Creek channel. Due to the incised nature of the channel in this location the maximum berm height only occurs for a maximum distance of 300' while it transitions to the maximum of height of the majority of the berm of 9'
5. Maximum berm height from OSMP property occurs near the existing Bobolink Trailhead. The localized maximum can be found at the South Boulder Creek channel, which is 16 feet tall.

TABLE 4
Comparison of Total Berm Area

Berm ID	Total Berm Area (Acres) (OSMP Memorandum)	Total Berm Area (Acres) (Refined Alternative Design)	Total Berm Area on OSMP Land (Acres) (Refined Alternative Design)
US-36 Regional Detention (Alt 3)	9.09	27.60	5.50
US-36 Distributed Detention (Alt 5)	9.09	19.72	17.01
South Boulder Road Distributed Detention (Alt 5)	10.44	11.0	10.36
Baseline Road Distributed Detention (Alt 5)	10.74	7.72	7.42
Totals for Alt 5	30.3	38.44	34.79

TABLE 5
Comparison of Ute Ladies' Tresses Orchid affected Area

Berm ID	Total Ute Ladies' Tresses Orchid affected Area (Acres) (OSMP Memorandum)	Total Ute Ladies' Tresses Orchid affected Area ¹ (Acres) (Refined Alternative Design)
US-36 Regional Detention (Alt 3)	9.09	5.50
US-36 Distributed Detention (Alt 5)	9.09	17.01
South Boulder Road Distributed Detention (Alt 5)	10.44	10.36
Baseline Road Distributed Detention (Alt 5)	10.74	7.42
Totals for Alt 5	30.3	34.79

1. Affected area assumed to be on OSMP land only. It was assumed the roadway right of way and privately held parcels did not contain habitat suitable to the Ute Ladies' Tresses Orchid.

TABLE 6
Comparison of affected Riparian/Wetlands Area

Berm ID	Total Riparian/Wetlands Area (Acres) ¹ (OSMP Memorandum)	Total Riparian/Wetlands Area (Acres) ¹ (Refined Alternative Design)	Total City of Boulder Regulatory Wetlands (Acres) ² (Refined Alternative Design)	
			Class A Inner	Class A Outer
US-36 Regional Detention (Alt 3)	4.88	3.6	0	0
US-36 Distributed Detention (Alt 5)	4.88	11.2	0	0
South Boulder Road Distributed Detention (Alt 5)	4.33	2.3	2.76	0.80
Baseline Road Distributed Detention (Alt 5)	5.05	3.8	2.65	0.70
Totals for Alt 5	14.3	17.3	5.41	1.50

1. Affected area calculated using the WetlandsRiparian_VegMap.shp provided by OSMP.
2. Affected area calculated using the shapefile Wetlands.shp provide by the City of Boulder.

TABLE 7
Comparison of Northern Leopard Frog affected Area

Berm ID	Total Northern Leopard Frog Affected Area (Acres) (OSMP Memorandum)	Total Northern Leopard Frog Affected Area (Acres) (Refined Alternative Design)
	US-36 Regional Detention (Alt 3)	4.88
US-36 Distributed Detention (Alt 5)	4.88	11.2
South Boulder Road Distributed Detention (Alt 5)	4.33	2.3
Baseline Road Distributed Detention (Alt 5)	5.05	3.8
Totals for Alt 5	14.3	17.3

TABLE 8
Comparison of affected PMJM Critical Habitat Area

Berm ID	Total PMJM Critical Habitat (Acres) ¹ (OSMP Memorandum)	Total PMJM Critical Habitat (Acres) (Refined Alternative Design)	
		OSMP Property	Other Property ¹
US-36 Regional Detention (Alt 3)	1.27	1.0	0.6
US-36 Distributed Detention (Alt 5)	1.27	9.6	0.6
South Boulder Road Distributed Detention (Alt 5)	3.24	4.0	0
Baseline Road Distributed Detention (Alt 5)	3.34	2.7	0
Totals for Alt 5	7.9	16.3	0.6

1. Other Property includes roadway right of way and private property

TABLE 9
Comparison of affected PMJM Conservation Area

Berm ID	Total PMJM Conservation Area (Acres) ¹ (OSMP Memorandum)	Total PMJM Conservation Area (Acres) (Refined Alternative Design)	
		OSMP Property	Other Property ¹
US-36 Regional Detention (Alt 3)	7.68	4.9	2.2
US-36 Distributed Detention (Alt 5)	7.68	16.0	2.2
South Boulder Road Distributed Detention (Alt 5)	6.4	7.1	0
Baseline Road Distributed Detention (Alt 5)	6.15	4.4	0
Totals for Alt 5	20.2	27.5	2.2

1. Other Property includes roadway right of way and private property

TABLE 10
Comparison of South Boulder Creek State Natural Area

Berm ID	Total South Boulder Creek State Natural Area (Acres) (OSMP Memorandum)	Total South Boulder Creek State Natural Area (Acres) (Refined Alternative Design)
	US-36 Regional Detention (Alt 3)	8.17
US-36 Distributed Detention (Alt 5)	8.17	16.1
South Boulder Road Distributed Detention (Alt 5)	10.32	10.4
Baseline Road Distributed Detention (Alt 5)	6.7	4.8
Totals	25.2	31.3

In addition to those items quantified in the OSMP memorandum dated April 13, 2011, several additional impacts to resources were quantified by this Refined Alternative Design. These items included impacts to irrigation infrastructure and impacts to agricultural lands.

TABLE 11
Impacts to Irrigation Infrastructure

Berm ID	Head Gates	Irrigation Ditches (If)							
		Howard Ditch		Anderson Ditch		Dry Creek No. 2 Ditch		Shearer Ditch	
		Main Ditch	Laterals	Main Ditch	Laterals	Main Ditch	Laterals	Main Ditch	Laterals
US-36 Regional Detention (Alt 3)	0	0	0	58	0	559	726	0	0
US-36 Distributed Detention (Alt 5)	0	0	0	0	0	458	3,199	0	0
South Boulder Road Distributed Detention (Alt 5)	1	0	0	221	0	728	1,198	0	1,365
Baseline Road Distributed Detention (Alt 5)	2	210	600	0	0	0	0	0	0
Totals for Alt 5	3	210	600	221	0	1,186	4,397	0	1,365

TABLE 12
Impacts to Agricultural Lands

Berm ID	Agricultural Fields (Acres)		
	Hay Production ¹	Grazing	Hay Production and Grazing ¹
US-36 Regional Detention (Alt 3)	0	5.2	0
US-36 Distributed Detention (Alt 5)	0	15.8	0
South Boulder Road Distributed Detention (Alt 5)	0	0	3.2
Baseline Road Distributed Detention (Alt 5)	0	3.5	0
Totals for Alt 5	0	19.3	3.2

1. Based on OSMP GIS layer files defining agricultural land use areas where only hay is produced and where hay and grazing occurs together.

Summary and Conclusions

The Refined Alternative Design for Alternative 5 – Distributed Regional Detention indicate that the impacts to Open Space lands are likely less than those reported in the OSMP memorandum dated April 13, 2011. The exception to this is the berm located at South Boulder Road. Due to the berm, the Viele Channel will need to be modified slightly which increases the impacts of this alternative to the metrics on Open Space lands. The draft OSMP memorandum did not specifically analyze impacts associated with the US-36 Regional Detention Alternative. As a result, only a comparison between CH2M HILL and OSMP impact estimates on resources are presented for the Distributed Regional Detention Alternative.

Distributed Regional Detention

– Maximum Berm Height

- **US-36** – 12 feet on OSMP property, 6 feet less than the 18-foot value reported in the Memorandum.
- **South Boulder Road** – 14 feet located only within the South Boulder Creek channel. For the remainder of the berm a maximum height 13 feet tall, 1 foot less than the 14-foot value reported in the Memorandum is reached just east of South Boulder Creek.
- **Baseline Road** – 18 feet located only within the South Boulder Creek channel. For the remainder of the berm reaches a maximum height 11 feet tall, 7 feet less than the 18-foot value reported in the Memorandum.

– Total Berm Area and impact to Ute Ladies' Tresses Orchid Habitat-

- **US-36** – 17.0 acres on OSMP property, 8 acres more than the 9.09 acres reported in the Memorandum. The total footprint area of 19.7 acres includes CDOT Right of way and includes all required maintenance easements.
- **South Boulder Road** – 10.36 acres on OSMP property, 0.8 acres less than the 10.44 acres reported in the Memorandum. The total footprint area of 11.0 acres includes roadway right of way and includes all required maintenance easements on private property for Dry Creek Ditch No. 2.
- **Baseline Road** – 7.42 acres on OSMP property, 3.32 acres less than the 10.74 acres reported in the Memorandum. The total footprint area of 7.72 acres includes roadway right of way and includes all required maintenance easements on private property (Granite Property).

– Total Disturbance to Riparian/ Wetlands Vegetation and Northern Leopard Frog Habitat

- **US-36** – 11.2 acres on OSMP property, 6.3 acres more than the 4.88 acres reported in the Memorandum.
- **South Boulder Road** – 2.3 acres on OSMP property, 2.0 acres less than the 4.3 acres reported in the Memorandum.
- **Baseline Road** – 3.75 acres on OSMP property, 1.3 acres less than the 5.05 acres reported in the Memorandum.

– Total Disturbance to PMJM Critical Habitat

- **US-36** – 9.6 acres on OSMP property, 8.3 acres more than the 1.27 acres reported in the Memorandum. There is a total impact of 10.2 acres of impact to the PMJM Critical Habitat area including property on CDOT right of way for this alternative.
- **South Boulder Road** – 4.0 acres on OSMP property, 0.76 acres greater than the 3.24 acres reported in the Memorandum.
- **Baseline Road** – 2.7 acres on OSMP property, 0.64 acres less than the 3.34 acres reported in the Memorandum.

– Total Disturbance to PMJM Conservation Zones

- **US-36** – 16.0 acres on OSMP property, 8.32 acres less than the 7.68 acres reported in the Memorandum. There is a total impact of 18.2 acres of impact to the PMJM Conservation area including property on CDOT right of way for this alternative.
- **South Boulder Road** – 7.1 acres on OSMP property, 0.7 acres greater than the 6.4 acres reported in the Memorandum.
- **Baseline Road** – 4.4 acres on OSMP property, 1.72 acres less than the 6.15 acres reported in the Memorandum.

– **Total Disturbance to the South Boulder Creek Natural Area**

- **US-36** – 16.1 acres on OSMP property, 7.93 acres more than the 8.17 acres reported in the Memorandum.
- **South Boulder Road** – 10.4 acres on OSMP property, 0.1 acres greater than the 10.32 acres reported in the Memorandum.
- **Baseline Road** – 4.8 acres on OSMP property, 1.9 acres less than the 6.7 acres reported in the Memorandum.